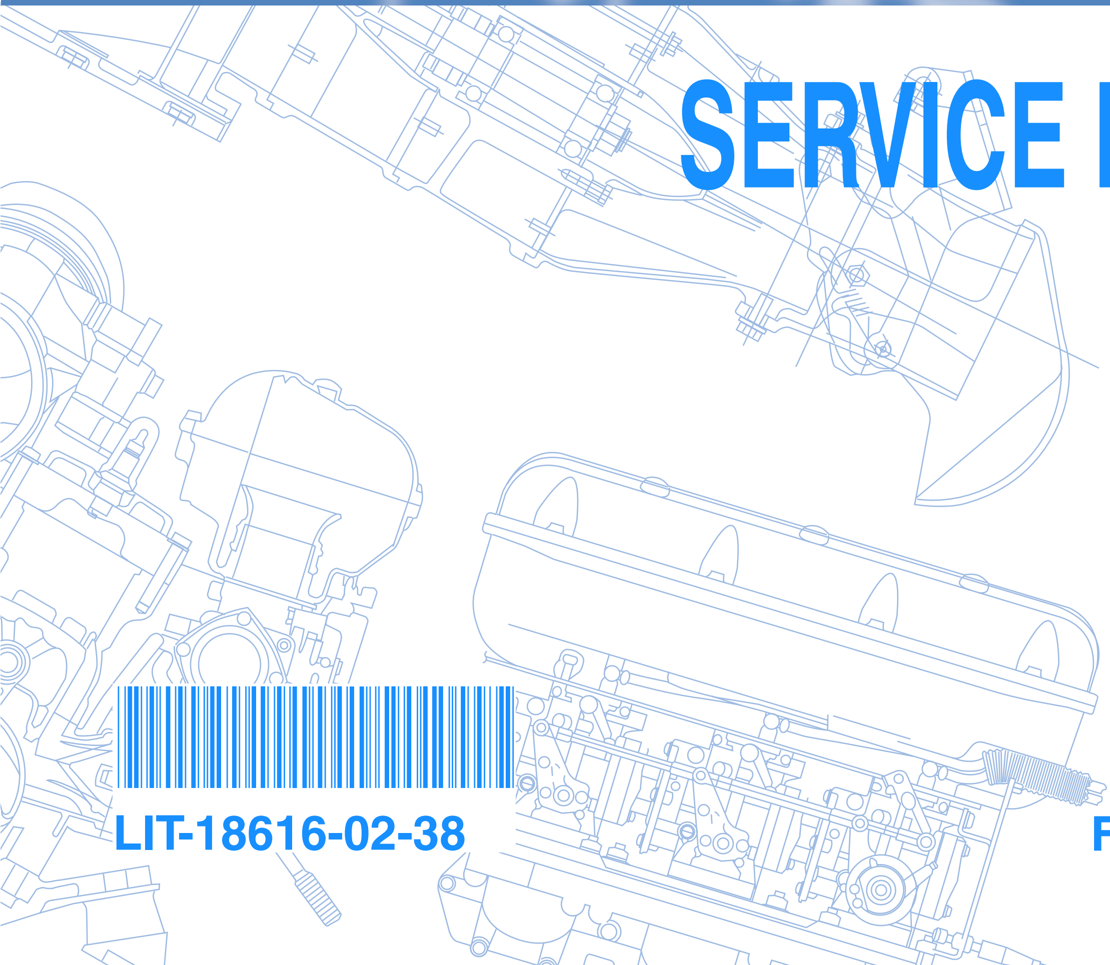
YAMAHA

# WaveRunner

# FX140



# SERVICE MANUAL



LIT-18616-02-38

F1B-28197-1E-11

# NOTICE

This manual has been prepared by Yamaha primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because Yamaha has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

A10001-0*

**WaveRunner FX140**
**SERVICE MANUAL**

**1st Edition, February 2002**

**Printed in USA**
**LIT-18616-02-38**

# HOW TO USE THIS MANUAL

## MANUAL FORMAT

All of the procedures in this manual are organized in a sequential, step-by-step format. The information has been compiled to provide the mechanic with an easy to read, handy reference that contains comprehensive explanations of all disassembly, repair, assembly, and inspection operations.
In this revised format, the condition of a faulty component will precede an arrow symbol and the course of action required will follow the symbol, e.g.,

- Bearings
  Pitting/scratches → Replace.

To assist you in finding your way through this manual, the section title and major heading is given at the top of every page.

## ILLUSTRATIONS

The illustrations within this service manual represent all of the designated models.

## CROSS REFERENCES

The cross references have been kept to a minimum. Cross references will direct you to the appropriate section or chapter.

## IMPORTANT INFORMATION

In this Service Manual particularly important information is distinguished in the following ways.

⚠ The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

**⚠ WARNING**

**Failure to follow WARNING instructions could result in severe injury or death to the machine operator, passenger(s), a bystander, or a person inspecting or repairing the watercraft.**

**CAUTION:**

**A CAUTION indicates special precautions that must be taken to avoid damage to the watercraft.**

**NOTE:**

A NOTE provides key information to make procedures easier or clearer.

**IMPORTANT:**

This part has been subjected to change of specification during production.

## HOW TO USE THIS MANUAL

① To help identify parts and clarify procedure steps, there are exploded diagrams at the start of each removal and disassembly section.

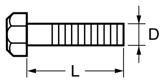
② Numbers are given in the order of the jobs in the exploded diagram.

③ Symbols indicate parts to be lubricated or replaced (see “SYMBOLS”).

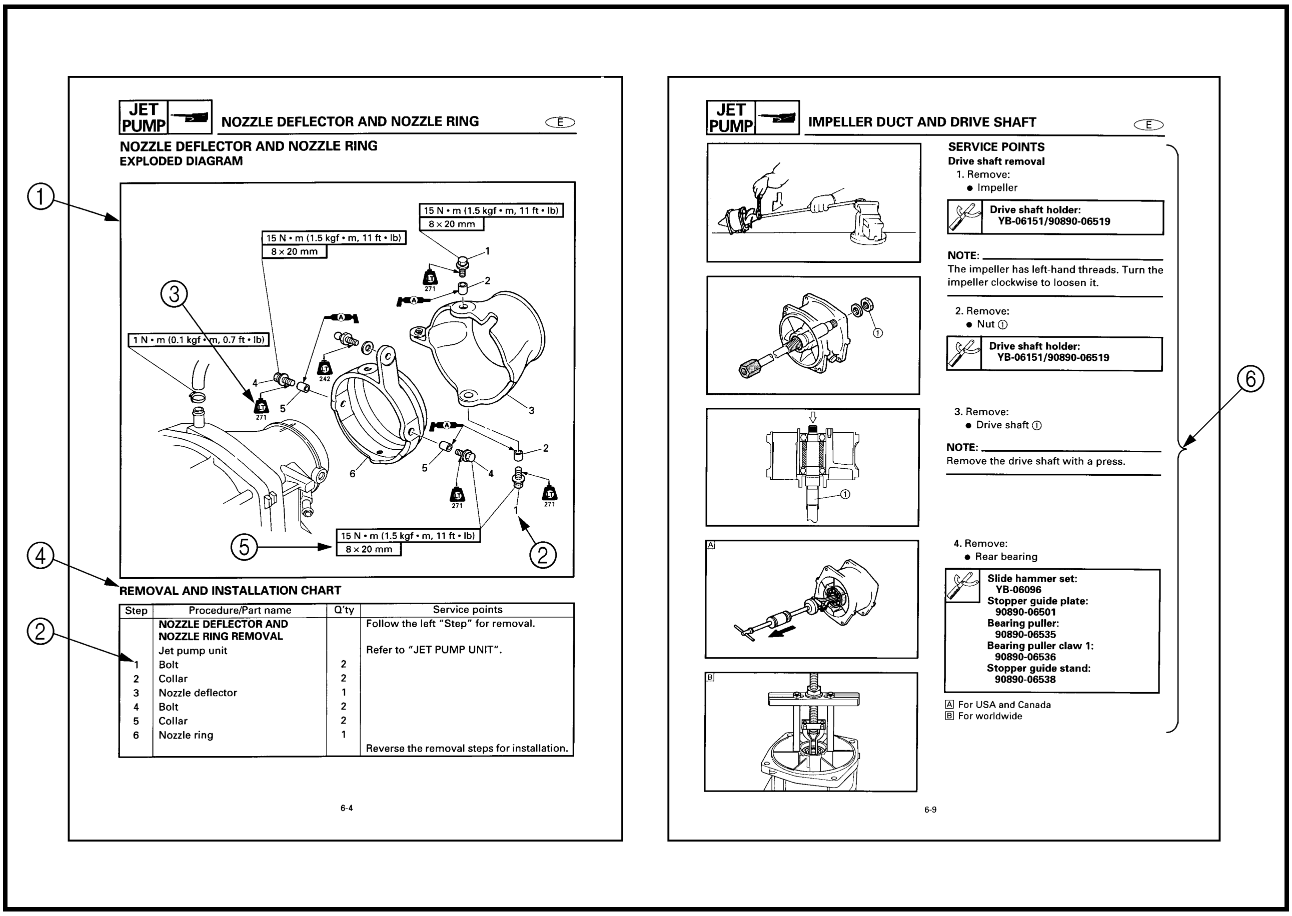
④ A job instruction chart accompanies the exploded diagram, providing the order of jobs, names of parts, notes in jobs, etc.

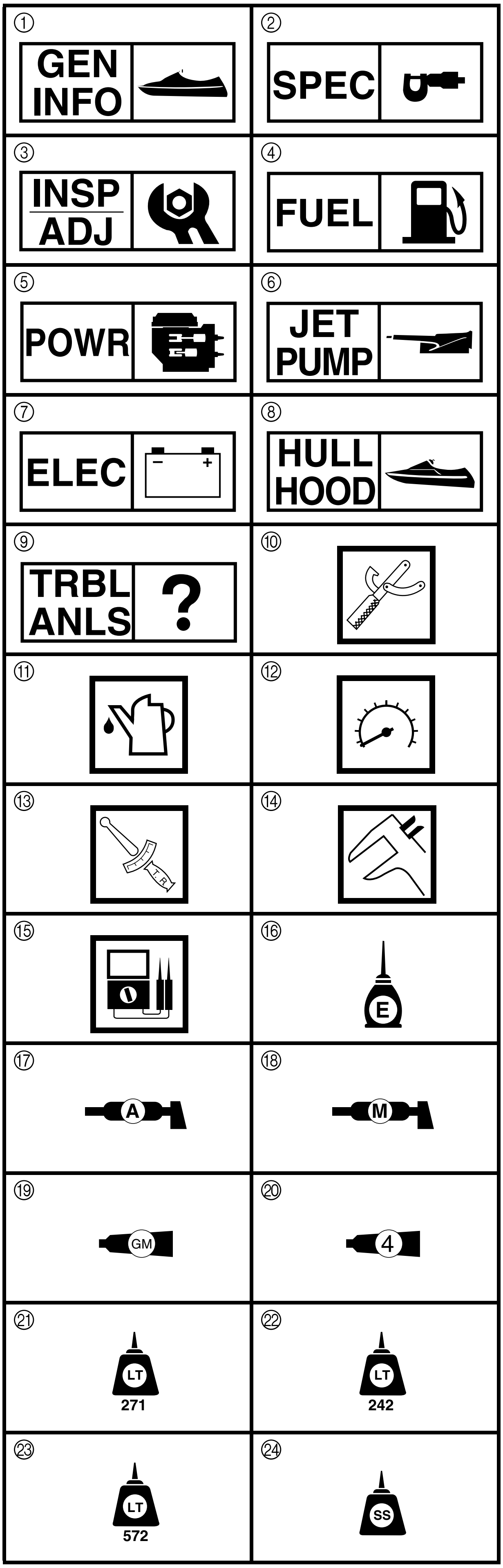
⑤ Dimension figures and the number of parts, are provided for fasteners that require a tightening torque.

Example:
Bolt or screw size  10 × 25 mm : M10 (D) × 25 mm (L)




⑥ Jobs requiring more information (such as special tools and technical data) are described sequentially.






A50001-1-4

## SYMBOLS

Symbols ① to ⑨ are designed as thumb-tabs to indicate the content of a chapter.

① General Information
② Specifications
③ Periodic Inspection and Adjustment
④ Fuel System
⑤ Power Unit
⑥ Jet Pump Unit
⑦ Electrical System
⑧ Hull and Hood
⑨ Trouble analysis

Symbols ⑩ to ⑮ indicate specific data:

⑩ Special tool
⑪ Specified liquid
⑫ Specified engine speed
⑬ Specified torque
⑭ Specified measurement
⑮ Specified electrical value
[Resistance (Ω), Voltage (V), Electric current (A)]

Symbol ⑯ to ⑱ in an exploded diagram indicate the grade of lubricant and the location of lubrication point:

⑯ Apply YAMALUBE 4-stroke motor oil
⑰ Apply water resistant grease
(Yamaha grease A, Yamaha marine grease)
⑱ Apply molybdenum disulfide grease

Symbols ⑲ to ㉔ in an exploded diagram indicate the grade of the sealing or locking agent, and the location of the application point:

⑲ Apply Gasket Maker®
⑳ Apply Yamabond #4 (Yamaha bond number 4)
㉑ Apply LOCTITE® No. 271 (Red LOCTITE)
㉒ Apply LOCTITE® No. 242 (Blue LOCTITE)
㉓ Apply LOCTITE® No. 572
㉔ Apply silicone sealant

**NOTE:**
In this manual, the above symbols may not be used in every case.

A30000-0

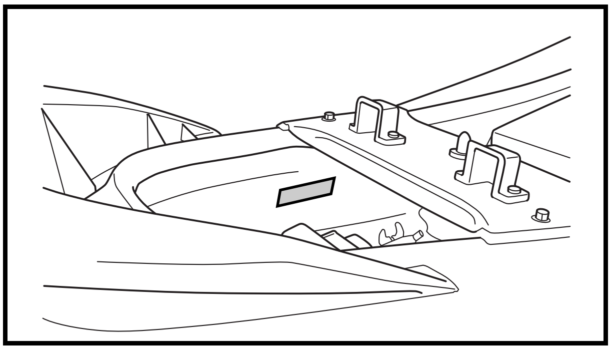
# INDEX

# CHAPTER 1
# GENERAL INFORMATION

A60700-0*

# IDENTIFICATION NUMBERS

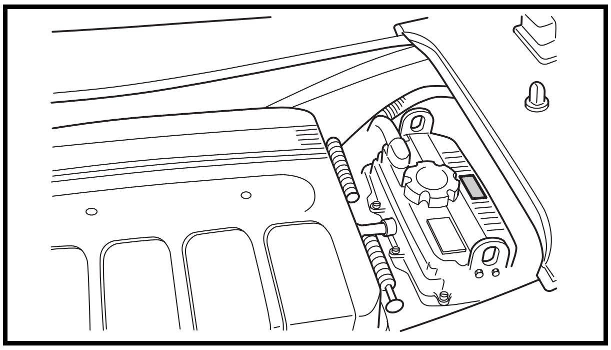
## PRIMARY I.D. NUMBER



The primary I.D. number is stamped on a label attached to the inside of the engine compartment.

**Starting primary I.D. number:**
**F1B: 800101**

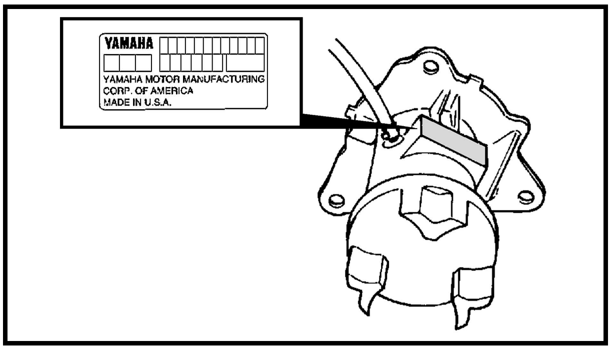
## ENGINE SERIAL NUMBER



The engine serial number is stamped on a label attached to the engine unit.

**Starting serial number:**
**60E: 000101**

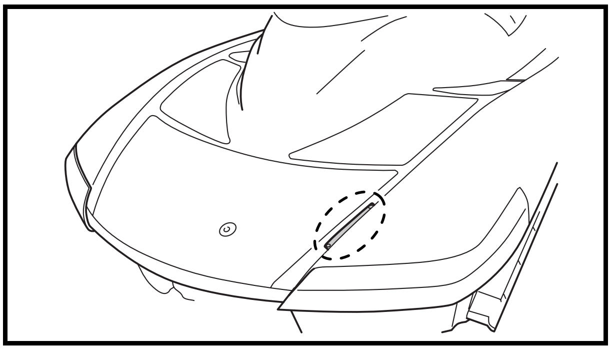
## JET PUMP UNIT SERIAL NUMBER




The jet pump unit serial number is stamped on a label attached to the intermediate housing.

**Starting serial number:**
**60E: 800058**

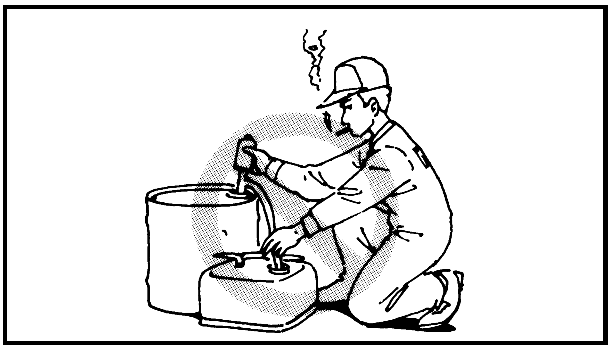
## HULL IDENTIFICATION NUMBER (H.I.N.)



The H.I.N. is stamped on a plate attached to the aft deck.

## ⚠ SAFETY WHILE WORKING

The procedures given in this manual are those recommended by Yamaha to be followed by Yamaha dealers and their mechanics.

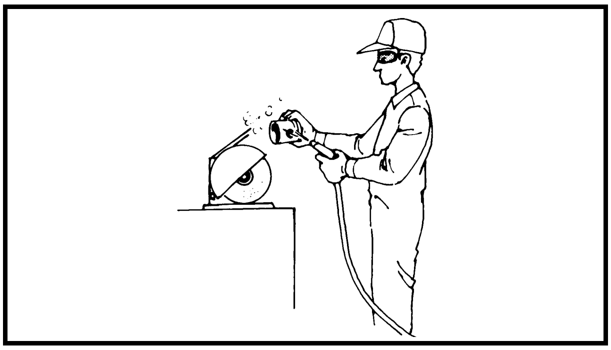


### FIRE PREVENTION

Gasoline (petrol) is highly flammable.
Gasoline vapor is explosive if ignited.
Do not smoke while handling gasoline (petrol) and keep it away from heat, sparks, and open flames.

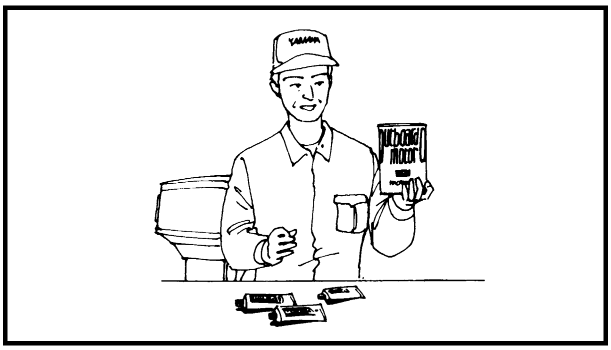
### VENTILATION

Gasoline vapor is heavier than air and is deadly if inhaled in large quantities. Engine exhaust gases are harmful to breathe. When test-running an engine indoors, maintain good ventilation.



### SELF-PROTECTION

Protect your eyes with suitable safety spectacles or safety goggles when grinding or doing any operation which may cause particles to fly off.
Protect hands and feet by wearing safety gloves or protective shoes if appropriate to the work you are doing.



### OILS, GREASES AND SEALING FLUIDS

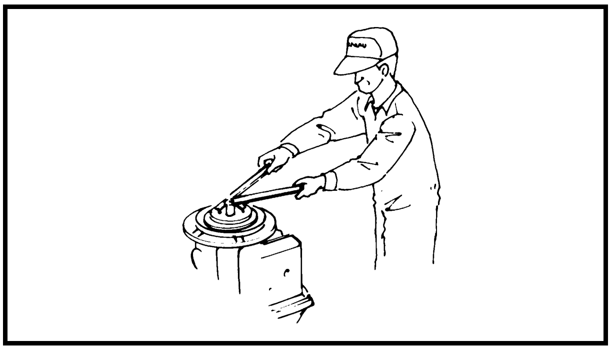
Use only genuine Yamaha oils, greases, and sealing fluids or those recommended by Yamaha.

# ⚠ SAFETY WHILE WORKING



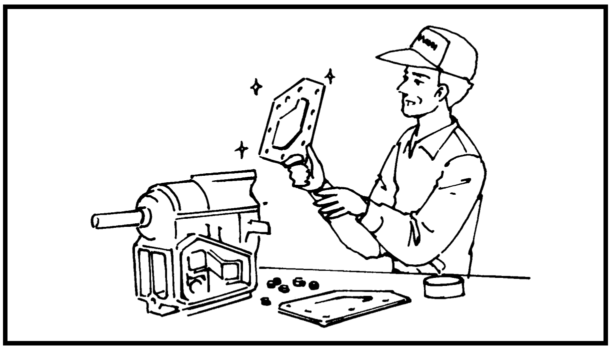
Under normal conditions of use there should be no hazards from the use of the lubricants mentioned in this manual, but safety is all-important, and by adopting good safety practises any risk is minimized. A summary of the most important precautions is as follows:

1. While working, maintain good standards of personal and industrial hygiene.
2. Clothing which has become contaminated with lubricants should be changed as soon as practicable and laundered before further use.
3. Avoid skin contact with lubricants (e.g., do not place a soiled rag in your pocket).
4. Hands and any other part of the body which have been in contact with lubricants or lubricant-contaminated clothing should be thoroughly washed with hot water and soap as soon as practicable.
5. To protect the skin, the application of a suitable barrier cream to the hands before working is recommended.
6. A supply of clean lint-free cloths should be available for wiping purposes.

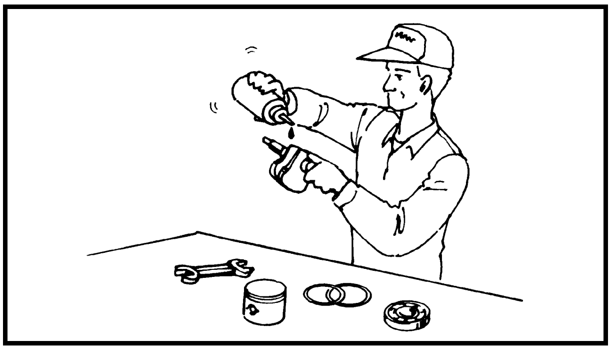


## GOOD WORKING PRACTICES

1. **The right tools**
   Use the recommended special tools to protect parts from damage. Use the right tool in the right manner – do not improvise.
2. **Tightening torque**
   Follow the tightening torque instructions. When tightening bolts, nuts and screws, tighten the larger sizes first and tighten inner-positioned fixings before outer-positioned ones.

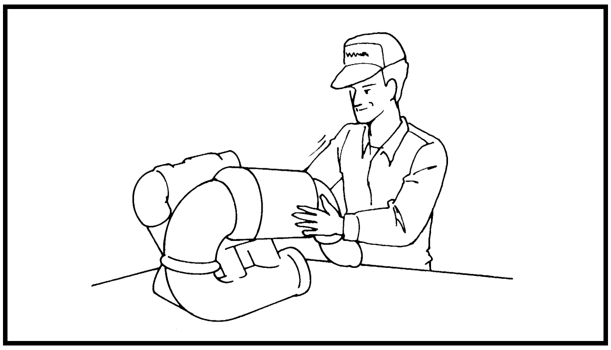


3. **Non-reusable items**
   Always use new gaskets, packings, O-rings, oil seals, split-pins, circlips, etc., on reassembly.



## DISASSEMBLY AND ASSEMBLY

1. Clean parts with compressed air when disassembling.
2. Oil the contact surfaces of moving parts during assembly.



3. After assembly, check that moving parts operate normally.
4. Install bearings with the manufacturer's markings on the side exposed to view and liberally oil the bearings.

**CAUTION:**

**Do not spin bearings with compressed air because this will damage their surfaces.**

5. When installing oil seals, apply a light coat of water-resistant grease to the outside diameter.

# SPECIAL TOOLS

Using the correct special tools recommended by Yamaha, will aid the work and enable accurate assembly and tune-up. Improvisations and using improper tools can damage the equipment.

**NOTE:**
- For U.S.A. and Canada, use part numbers starting with “J-”, “YB-”, “YM-”, “YS-”, “YU-” or “YW-”.
- For other countries, use part numbers starting with “90890-”.

## MEASURING

① Dial gauge
P/N. YU-03097
90890-01252

② Dial gauge stand
P/N. 90890-06583

③ Dial gauge needle
P/N. 90890-06584

④ Dial gauge stand set
P/N. YW-06585
90890-06585

⑤ Pocket tester
P/N. YU-03112
90890-03112

⑥ Digital circuit tester
P/N. YU-34899-A
90890-03174

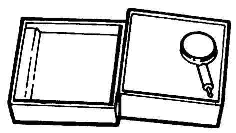
⑦ Carburetor synchronizer
P/N. YU-08030

⑧ Vacuum gauge
P/N. 90890-03094
Vacuum attachment
P/N. 90890-03060

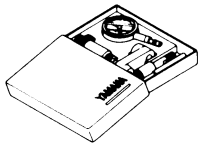
⑨ Test connector
P/N. YW-06862
90890-06862

⑩ Fuel pressure gauge adapter
P/N. YW-06842
90890-06842

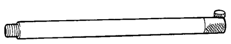
① YU-03097



90890-01252



② 90890-06583



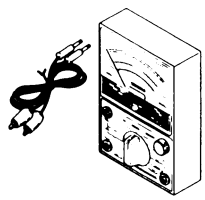
③ 90890-06584



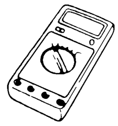
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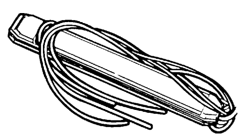
⑤ YU-03112
90890-03112



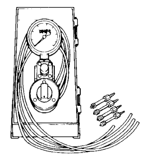
⑥ YU-34899-A
90890-03174



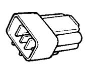
⑦ YU-08030



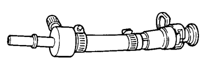
⑧ 90890-03094 90890-03060



⑨ YW-06862
90890-06862



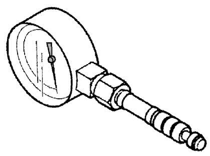
⑩ YW-06842
90890-06842



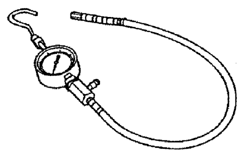
## SPECIAL TOOLS



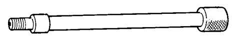
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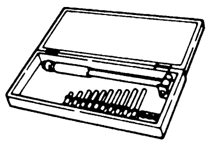
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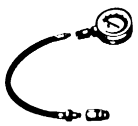
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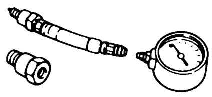
⑬ YU-03017
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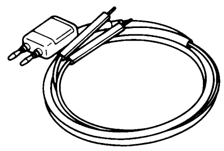
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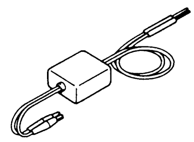
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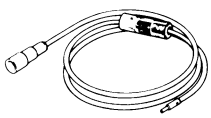
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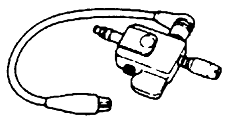
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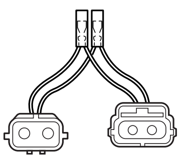
⑯ YM-34487



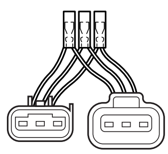
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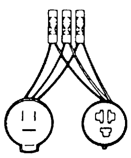
⑰ YB-06792
90890-06792



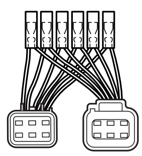
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90890-06791



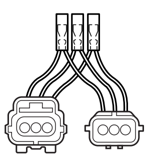
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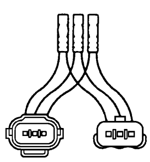
⑳ YB-06790
90890-06790



㉑ YB-06793
90890-06793



㉒ YB-06777
90890-06777



⑪ Fuel pressure gauge
P/N. YB-06766
90890-06786

⑫ Compression gauge extension
P/N. 90890-06582

⑬ Cylinder gauge set
P/N. YU-03017
90890-06759

⑭ Compression gauge
P/N. YU-33223-1
90890-03160

⑮ Peak voltage adapter
P/N. YU-39991
90890-03172

⑯ Spark gap tester
P/N. YM-34487
90890-06754

⑰ Test harness (2 pins)
P/N. YB-06792
90890-06792

⑱ Test harness (3 pins)
P/N. YB-06791
90890-06791

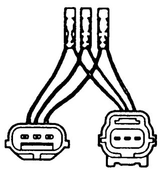
⑲ Test harness (3 pins)
P/N. YB-06770
90890-06770

⑳ Test harness (6 pins)
P/N. YB-06790
90890-06790

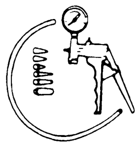
㉑ Test harness (3 pins)
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90890-06793

㉒ Test harness (3 pins)
P/N. YB-06777
90890-06777

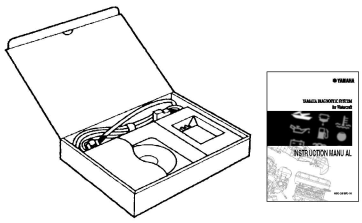
㉓ YB-06769
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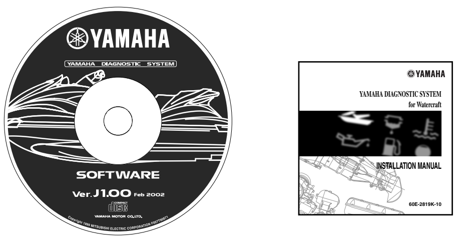
㉔ YB-35956-A
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㉕ 60E-85300-01



㉖ 60E-WS853-00



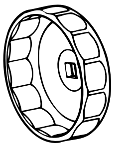

㉓ Test harness (3 pins)
P/N. YB-06769
90890-06769

㉔ Vacuum/pressure pump gauge set
P/N. YB-35956-A
90890-06756

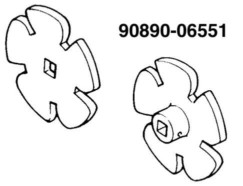
㉕ Yamaha diagnostic system for Watercraft
P/N. 60E-85300-01

㉖ Yamaha diagnostic system for Watercraft (CD-ROM only)
P/N. 60E-WS853-00

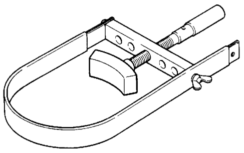
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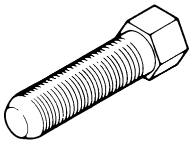
② YW-06551



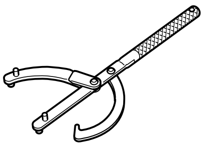

③ YS-01880-A
90890-01701



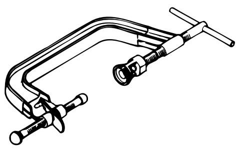
④ YM-01082
90890-01080



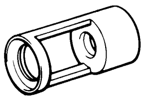
⑤ YU-01235
90890-01235



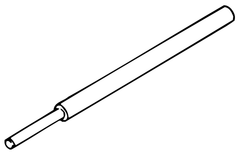
⑥ YM-04019
90890-04019



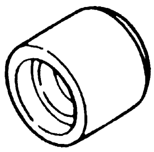
⑦ YM-4114 (ø19 mm)
90890-04114 (ø19 mm)
YM-4108 (ø22 mm)
90890-04108 (ø22 mm)



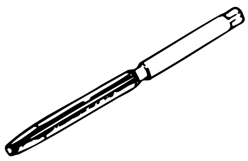
⑧ YM-04111 (ø4.0 mm)
90890-04111 (ø4.0 mm)
YM-04116 (ø4.5 mm)
90890-04116 (ø4.5 mm)



⑨ YM-04112 (ø4.0 mm)
90890-04112 (ø4.0 mm)
YM-04117 (ø4.5 mm)
90890-04117 (ø4.5 mm)



⑩ YM-04113 (ø4.0 mm)
90890-04113 (ø4.0 mm)
YM-04118 (ø4.5 mm)
90890-04118 (ø4.5 mm)



## REMOVAL AND INSTALLATION

① Oil filter wrench
P/N. YU-38411
90890-01426

② Coupler wrench
P/N. YW-06551
90890-06551

③ Sheave holder
P/N. YS-01880-A
90890-01701

④ Rotor puller
P/N. YM-01082
90890-01080

⑤ Rotor holder
P/N. YU-01235
90890-01235

⑥ Valve spring compressor
P/N. YM-04019
90890-04019

⑦ Valve spring compressor attachment
P/N. YM-4114 (ø19 mm)
90890-04114 (ø19 mm)
YM-4108 (ø22 mm)
90890-04108 (ø22 mm)

⑧ Valve guide remover
P/N. YM-04111 (ø4.0 mm)
90890-04111 (ø4.0 mm)
YM-04116 (ø4.5 mm)
90890-04116 (ø4.5 mm)

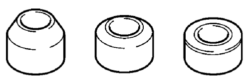
⑨ Valve guide installer
P/N. YM-04112 (ø4.0 mm)
90890-04112 (ø4.0 mm)
YM-04117 (ø4.5 mm)
90890-04117 (ø4.5 mm)

⑩ Valve guide reamer
P/N. YM-04113 (ø4.0 mm)
90890-04113 (ø4.0 mm)
YM-04118 (ø4.5 mm)
90890-04118 (ø4.5 mm)

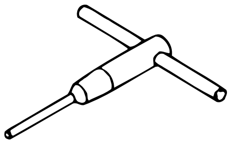
# SPECIAL TOOLS



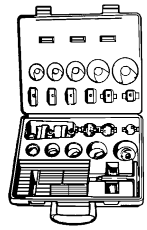
⑪ 90890-06813 (60°) 90890-06814 (45°) 90890-06815 (30°) | 90890-06315 (60°) 90890-06312 (45°) 90890-06328 (30°)



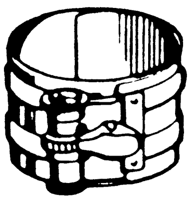
⑫ 90890-06811 (ø4.0 mm) 90890-06812 (ø4.5 mm)



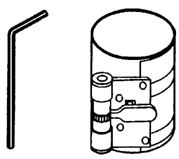
⑬ YM-91043-C



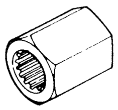
⑭ YM-08037



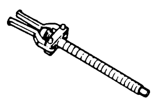
90890-05158



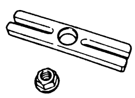
⑮ YB-06151 90890-06519



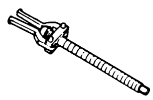
⑯ YB-06096



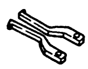
⑰ 90890-06501



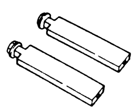
⑱ 90890-06535



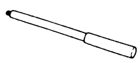
⑲ 90890-06536



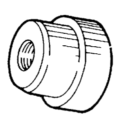
⑳ 90890-06538



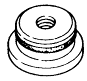
㉑ 90890-06652



㉒ YB-06112 YB-06196



90890-06614 90890-06653



⑪ Valve seat cutter
Intake
P/N. 90890-06813 (60°)
90890-06814 (45°)
90890-06815 (30°)
Exhaust
P/N. 90890-06315 (60°)
90890-06312 (45°)
90890-06328 (30°)

⑫ Valve seat cutter holder
P/N. 90890-06811 (ø4.0 mm)
90890-06812 (ø4.5 mm)

⑬ Valve seat cutter set
P/N. YM-91043-C

⑭ Piston ring compressor
P/N. YM-08037
90890-05158

⑮ Drive shaft holder (impeller)
P/N. YB-06151
90890-06519

⑯ Slide hammer set (jet pump bearing)
P/N. YB-06096

⑰ Stopper guide plate (jet pump bearing)
P/N. 90890-06501

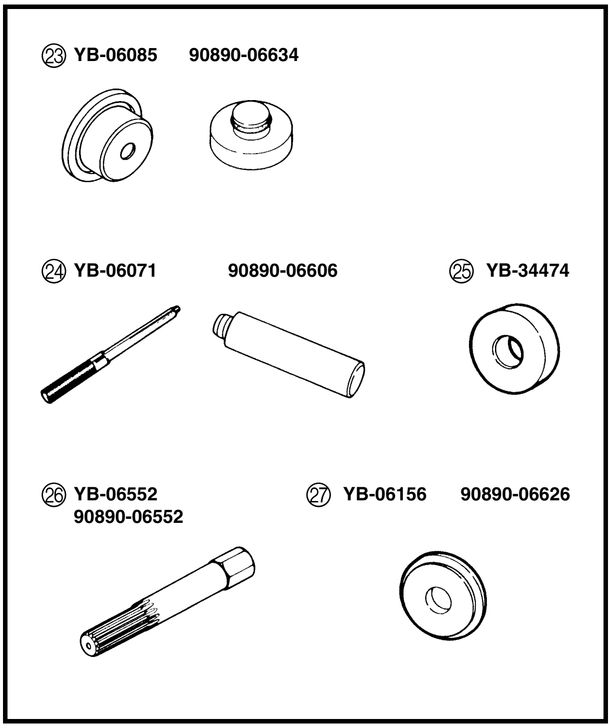
⑱ Bearing puller (jet pump bearing)
P/N. 90890-06535

⑲ Bearing puller claw 1 (jet pump bearing)
P/N. 90890-06536

⑳ Stopper guide stand (jet pump bearing)
P/N. 90890-06538

㉑ Drive rod L3 (jet pump bearing)
P/N. 90890-06652

㉒ Needle bearing attachment
(jet pump bearing and oil seal)
P/N. YB-06112, YB-06196
90890-06614, 90890-06653




㉓ Ball bearing attachment
(jet pump oil seal)
P/N. YB-06085
90890-06634

㉔ Driver rod
(intermediate shaft and jet pump)
P/N. YB-06071
90890-06606

㉕ Bearing inner/outer race attachment
(jet pump bearing)
P/N. YB-34474

㉖ Shaft holder (intermediate shaft)
P/N. YB-06552
90890-06552

㉗ Bearing outer race attachment
(intermediate shaft)
P/N. YB-06156
90890-06626

# CHAPTER 2
# SPECIFICATIONS

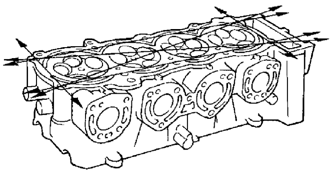
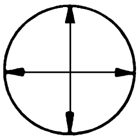
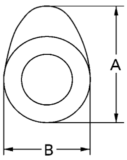
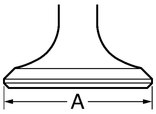
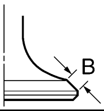
# GENERAL SPECIFICATIONS

| Item | Unit | Model |
|---|---|---|
| | | FX140 |
| Model code | | |
| Hull | | F1B |
| Engine/jet | | 60E |
| Dimensions | | |
| Length | mm (in) | 3,340 (131.5) |
| Width | mm (in) | 1,230 (48.4) |
| Height | mm (in) | 1,160 (45.7) |
| Dry weight | kg (lb) | 362 (798) |
| Maximum capacity | Person/kg (lb) | 3/240 (530) |
| Performance | | |
| Maximum output | kW (PS) @ r/min | 103 (140) @ 10,000 |
| Maximum fuel consumption | l/h (US gal/h, Imp gal/h) | 44 (11.6, 9.7) |
| Cruising range | h | 1.59 |
| Engine | | |
| Engine type | | 4-stroke, L4, DOHC |
| Displacement | $cm^3$ (cu. in) | 998 (60.9) |
| Bore × stroke | mm (in) | 74.0 × 58.0 (2.91 × 2.28) |
| Compression ratio | | 11.4:1 |
| Exhaust system | | Wet exhaust |
| Lubrication system | | Dry sump |
| Cooling system | | Water cooled |
| Starting system | | Electric starter |
| Ignition system | | TCI |
| Ignition timing | Degree | BTDC 35–ATDC 5 |
| Spark plug model (manufacturer) | | CR9EB (NGK) |
| Spark plug gap | mm (in) | 0.7–0.8 (0.028–0.031) |
| Battery capacity | V/Ah | 12/19 |
| Generator output | A @ r/min | 14–16 @ 6,000 |
| Drive unit | | |
| Propulsion system | | Jet pump |
| Jet pump type | | Axial flow, single stage |
| Impeller rotation (from rear) | | Counterclockwise |
| Transmission | | Direct drive from engine |
| Gear ratio | | 19/28 (0.68) |
| Jet thrust nozzle horizontal angle | Degree | 24 + 24 |
| Jet thrust nozzle trim angle | Degree | –10, –5, 0, 5, 10 |
| Trim system | | Manual 5 positions |
| Reverse system | | Reverse gate |

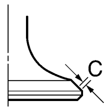
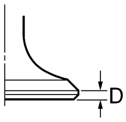
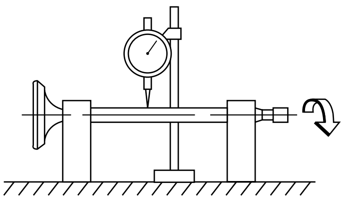
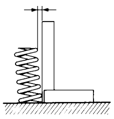
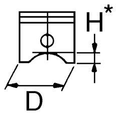
| Item | Unit | Model FX140 |
|---|---|---|
| Fuel and oil | | |
| Fuel type | | Regular unleaded gasoline |
| Minimum fuel rating | PON* | 86 |
| | RON* | 90 |
| Fuel tank capacity | L (US gal, Imp gal) | 70 (18.5, 15.4) |
| Engine oil type | | 4-stroke motor oil |
| Engine oil grade | API | SE, SF, SG, SH, or SJ |
| | SAE | 10W-30 |
| Engine oil quantity | L (US qt, Imp qt) | 4.3 (4.5, 3.8) |
| (without oil filter replacement) | L (US qt, Imp qt) | 2.0 (2.1, 1.8) |
| (with oil filter replacement) | L (US qt, Imp qt) | 2.2 (2.3, 1.9) |

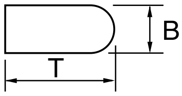
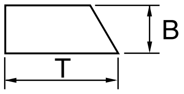
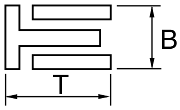
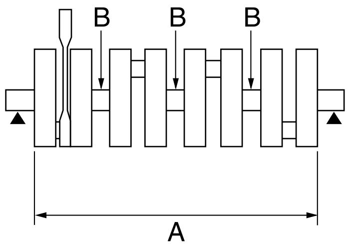
PON*: Pump Octane Number = (Motor Octane Number + Research Octane Number)/2
RON*: Research Octane Number

# MAINTENANCE SPECIFICATIONS
## ENGINE

| Item | Unit | Model |
|---|---|---|
| | | FX140 |
| Cylinder head | | |
| Warpage limit | mm (in) | 0.1 (0.004) |
|  | | |
| Compression pressure*1 | kPa (kgf/cm$^2$, psi) | 1,350 (13.5, 192) |
| Cylinder | | |
| Bore size | mm (in) | 74.060–74.075 (2.9157–2.9163) |
| Taper limit | mm (in) | 0.08 (0.003) |
| Out-of-round limit  | mm (in) | 0.05 (0.002) |
| Wear limit | mm (in) | 74.2 (2.9213) |
| Camshaft | | |
| Drive system | | Chain drive |
| Intake A | mm (in) | 32.25 (1.270) |
| Exhaust A   | mm (in) | 32.65 (1.285) |
| Intake and exhaust B | mm (in) | 25.00 (0.984) |
| Camshaft cap inside diameter | mm (in) | 24.5 (0.9646) |
| Camshaft journal diameter | mm (in) | 24.44–24.45 (0.9622–0.9626) |
| Camshaft-journal-to-camshaft-cap clearance | mm (in) | 0.05–0.08 (0.0020–0.0031) |
| Max.camshaft runout | mm (in) | 0.03 (0.0012) |
| Timing chain | | |
| Model/number of links | | DID SCR-0412SV/130 |
| Tensioning system | | Automatic |
| Valves, valve seats, valve guides | | |
| Valve clearance (cold) | | |
| Intake | mm (in) | 0.11–0.20 (0.0043–0.0079) |
| Exhaust | mm (in) | 0.25–0.34 (0.0098–0.0134) |
| Valve dimensions | | |
| Valve head diameter A | | |
| Intake | mm (in) | 22.9–23.1 (0.9016–0.9094) |
| Exhaust   | mm (in) | 24.4–24.6 (0.9606–0.9685) |
| Valve face width B | | |
| Intake | mm (in) | 1.76–2.90 (0.0693–0.1142) |
| Exhaust   | mm (in) | 1.76–2.90 (0.0693–0.1142) |

*1: At 760 mmHg and 20 °C (68 °F)

| Item | Unit | Model FX140 |
|---|---|---|
| Valve seat width C | | |
| Intake   | mm (in) | 0.9–1.1 (0.0354–0.0433) |
| Exhaust | mm (in) | 0.9–1.1 (0.0354–0.0433) |
| Valve margin thickness D | | |
| Intake   | mm (in) | 0.5–0.9 (0.0197–0.0354) |
| Exhaust | mm (in) | 0.5–0.9 (0.0197–0.0354) |
| Valve stem diameter | | |
| Intake | mm (in) | 3.975–3.990 (0.1565–0.1571) |
| Exhaust | mm (in) | 4.460–4.475 (0.1756–0.1762) |
| Valve guide inside diameter | | |
| Intake | mm (in) | 4.000–4.012 (0.1575–0.1580) |
| Exhaust | mm (in) | 4.500–4.512 (0.1772–0.1776) |
| Valve-stem-to-valve-guide clearance | | |
| Intake | mm (in) | 0.010–0.037 (0.0004–0.0015) |
| Exhaust | mm (in) | 0.025–0.052 (0.0010–0.0020) |
| Valve stem runout | mm (in) | 0.01 (0.0004) |
|  | | |
| Valve spring | | |
| Free length | | |
| Intake | mm (in) | 38.90 (1.53) |
| Exhaust | mm (in) | 40.67 (1.60) |
| Installed length | | |
| Intake | mm (in) | 34.50 (1.36) |
| Exhaust | mm (in) | 35.00 (1.38) |
| Spring limit  | | |
| Intake | Degree/mm (in) | 2.5/1.7 (0.067) |
| Exhaust | Degree/mm (in) | 2.5/1.8 (0.071) |
| Piston | | |
| Piston-to-cylinder clearance | mm (in) | 0.10–0.11 (0.0039–0.0043) |
| Piston diameter   | mm (in) | 73.955–73.970 (2.9116–2.9121) |
| Measuring point H* | mm (in) | 5 (0.2) |
| Wear limit | mm (in) | 0.17 (0.0067) |
| Piston pin boss inside diameter | mm (in) | 17.002–17.013 (0.6693–0.6698) |
| Piston pins | | |
| Outside diameter | mm (in) | 16.991–17.000 (0.6689–0.6693) |
| Wear limit | mm (in) | 16.971 (0.6681) |

| Item | Unit | Model<br>FX140 |
|---|---|---|
| Piston ring | | |
| Top ring   | | |
| Type | | Barrel |
| Dimension (B × T) | mm (in) | 0.90 × 2.75 (0.04 × 0.11) |
| End gap (installed) | mm (in) | 0.38–0.55 (0.0150–0.0217) |
| Ring groove clearance | mm (in) | 0.030–0.065 (0.0012–0.0026) |
| 2nd ring   | | |
| Type | | Taper |
| Dimensions (B × T) | mm (in) | 0.80 × 2.80 (0.03 × 0.11) |
| End gap (installed) | mm (in) | 0.49–0.69 (0.0193–0.0272) |
| Ring groove clearance | mm (in) | 0.020–0.055 (0.0008–0.0022) |
| Oil ring   | | |
| Dimensions (B × T) | mm (in) | 1.50 × 2.60 (0.06 × 0.10) |
| End gap (installed) | mm (in) | 0.29–0.59 (0.0114–0.0232) |
| Ring groove clearance | mm (in) | 0.040–0.160 (0.0016–0.0063) |
| Connecting rod | | |
| Big end oil clearance | mm (in) | 0.016–0.040 (0.0006–0.0016) |
| Bearing color code | | 1. Brown 2. Black 3. Blue 4. Green |
| Small end inside diameter | mm (in) | 17.005–17.018 (0.6694–0.6699) |
| Crankshaft   | | |
| Crank width A | mm (in) | 304.8–306.0 (12.00–12.05) |
| Deflection limit B | mm (in) | 0.03 (0.0012) |
| Crankshaft journal oil clearance | mm (in) | 0.020–0.057 (0.0008–0.0022) |
| Bearing color code | | 1. Brown 2. Black 3. Blue 4. Green 5. Yellow |
| Throttle body | | |
| Type/quantity | | 40EIS/4 |
| Manufacturer | | Mikuni |
| ID mark | | 60E00 |
| Trolling speed | r/min | 1,600–1,800 |
| Fuel pump | | |
| Pump type | | Electrical |
| Output pressure | kPa (kgf/cm$^2$, psi) | 310–330 (3.1–3.3, 45–47) |

| Item | Unit | Model FX140 |
|---|---|---|
| Oil filter | | |
| Oil filter type | | Cartridge type |
| Oil pump | | |
| Oil pump type | | Trochoid |
| Rotor tip clearance | mm (in) | 0.09–0.15 (0.004–0.006) |
| Oil pump housing clearance | | |
| Rotor (feed pump) | mm (in) | 0.09–0.17 (0.0035–0.0067) |
| Rotor (scavenge pump) | mm (in) | 0.09–0.19 (0.0035–0.0075) |

## JET PUMP UNIT

| Item | Unit | Model FX140 |
|---|---|---|
| Jet pump | | |
| Impeller material | | Stainless steel |
| Number of impeller blades | | 3 |
| Impeller pitch angle | Degree | 16.3 |
| Impeller clearance | mm (in) | 0.35–0.45 (0.01384–0.0177) |
| Impeller clearance limit | mm (in) | 0.6 (0.0236) |
| Drive shaft runout limit | mm (in) | 0.3 (0.0118) |
| Nozzle diameter | mm (in) | 86.5–87.1 (3.41–3.43) |

## HULL AND HOOD

| Item | Unit | Model FX140 |
|---|---|---|
| Free play | | |
| Throttle lever free play | mm (in) | 4–7 (0.16–0.28) |

## ELECTRICAL

| Item | Unit | Model FX140 |
|---|---|---|
| Battery | | |
| Type | | Fluid |
| Capacity | V/Ah | 12/19 |
| Specific gravity | | 1.28 |
| ECM unit | | |
| (B/R – Ground for cylinder #1 and #4) | | |
| (B/W – Ground for cylinder #2 and #3) | | |
| Output peak voltage lower limit | | |
| @cranking | V | 7 |
| @2,000 r/min | V | 258 |
| @3,500 r/min | V | 258 |

| Item | Unit | Model FX140 |
| --- | --- | --- |
| Stator | | |
| Pulser coil (W – B, R – B) | | |
| Output peak voltage | | |
| @cranking 1 | V | 4 |
| @cranking 2 | V | 4 |
| @2,000 r/min | V | 23 |
| @3,500 r/min | V | 38 |
| Lighting coil (G – G) | | |
| Output peak voltage | | |
| @cranking 1 | V | 9 |
| @cranking 2 | V | 8 |
| @2,000 r/min | V | 11 |
| @3,500 r/min | V | 12 |
| Pulser coil resistance | Ω (color) | 459–561 (W – B, R – B) |
| Pulser coil resistance 2 | Ω (color) | 459–561 (W – B, R – B) |
| Lighting coil resistance | Ω (color) | 0.54–0.66 (G – G) |
| Minimum charging current | A @ r/min | 14 @ 6,000 |
| Ignition coil | | |
| Minimum spark gap | mm (in) | 7–8 (0.28–0.31) |
| Primary coil resistance | Ω (color) | 1.53–2.07 (B/W – R) |
| Secondary coil resistance | kΩ | 12.5–16.9 |
| Spark plug lead resistance | | |
| #1 | kΩ | 6.4–14.9 |
| #2 | kΩ | 5.9–13.8 |
| #3 | kΩ | 4.7–11.1 |
| #4 | kΩ | 4.4–10.5 |
| Rectifier/regulator (R – B) | | |
| Output peak voltage (loaded) | | |
| @3,500 r/min | V | 14.5 |
| Starter motor | | |
| Type | | Constant mesh |
| Output | kW | 0.8 |
| Rating | Seconds | 30 |
| Brush length | mm (in) | 12.5 (0.49) |
| Wear limit | mm (in) | 6.5 (0.26) |
| Commutator undercut | mm (in) | 0.7 (0.03) |
| Limit | mm (in) | 0.2 (0.01) |
| Commutator diameter | mm (in) | 28.0 (1.10) |
| Limit | mm (in) | 27.0 (1.06) |
| Starter relay | | |
| Rating | Seconds | 30 |

Cranking 1: unloaded
Cranking 2: loaded

| Item | Unit | Model FX140 |
|---|---|---|
| Thermoswitch | | |
| ON temperature (Engine) | °C (°F) | 84–90 (183–194) |
| OFF temperature (Engine) | °C (°F) | 70–84 (158–183) |
| ON temperature (Exhaust) | °C (°F) | 94–100 (201–212) |
| OFF temperature (Exhaust) | °C (°F) | 80–94 (176–201) |
| Engine temperature sensor | | |
| Engine temperature sensor resistance (B/Y – B/Y) | | |
| @ 20 °C (68 °F) | kΩ | 54.2–69.0 |
| @ 100 °C (212 °F) | kΩ | 3.12–3.48 |
| Intake air temperature sensor | | |
| Intake air temperature sensor resistance | | |
| @ 0 °C (32 °F) | kΩ | 5.4–6.6 |
| @ 80 °C (176 °F) | kΩ | 0.29–0.39 |
| Intake air pressure sensor output voltage (P/G – B/O) | V @ kPa (kgf/cm$^2$, psi) | 4.00 @ 101.3 (1.01, 14.4) |
| | V @ kPa (kgf/cm$^2$, psi) | 1.97 @ 50 (0.5, 7.1) |
| | V @ kPa (kgf/cm$^2$, psi) | 0.79 @ 20 (0.2, 2.8) |
| Speed sensor | | |
| Output voltage (on pulse) | V | 11.6 |
| Output pulse/one full turn | | 2 |
| Throttle position sensor | | |
| Output voltage (P – B/O) | | |
| @ trolling speed | V | 0.760 ± 0.016 |
| Cam position sensor | | |
| Output voltage (G/O – B/O) | | |
| Position A | V | More than 0.8 |
| Position B | V | Less than 4.8 |
| Fuel sender | | |
| Fuel sender resistance | | |
| Position A | Ω | 91–93 |
| Position B | Ω | 6–8 |
| Oil pressure switch | | |
| Oil pressure switch continuity pressure | kPa (kgf/cm$^2$, psi) | 128 (12.8, 18.2)–166 (1.66, 23.6) |
| Fuel injector | | |
| Fuel injector resistance | Ω | 14.0–15.0 |
| Fuse | | |
| Rating | | |
| Main | V/A | 12/20 |
| Multifunction meter | V/A | 12/3 |
| Electrical bilge pump | V/A | 12/3 |

# TIGHTENING TORQUES
## SPECIFIED TORQUES

| Part to tightened | | Part name | Thread size | Q'ty | Tightening torque | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | N•m | kgf•m | ft•lb | |
| **Fuel system** | | | | | | | | |
| Retainer/fuel pump module – fuel tank | 1st | Nut | — | 9 | 3.2 | 0.32 | 2.3 | |
| | 2nd | | | | 6.4 | 0.64 | 4.6 | |
| Fuel filler neck/rubber seal – deck | | Nut | — | 1 | 5.9 | 0.59 | 4.3 | |
| Fuel tank belt/fuel tank – hull | | Bolt | M8 | 4 | 16 | 1.6 | 11 | LT 572 |
| Air filter case cover – air filter case | | Screw | M5 | 2 | 2.5 | 0.25 | 1.8 | LT 572 |
| Flame arrester – throttle bodies | 1st | Bolt | M6 | 4 | 3.3 | 0.33 | 2.4 | LT 242 |
| | 2nd | | | | 6.5 | 0.65 | 4.7 | |
| Throttle cable holder – air filter case | 1st | Bolt | M6 | 2 | 3.8 | 0.38 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Fuel hose holder – fuel hose bracket | 1st | Bolt | M4 | 2 | 1.7 | 0.17 | 1.2 | LT 572 |
| | 2nd | | | | 3.3 | 0.33 | 2.4 | |
| Throttle bodies – throttle body joint | 1st | Bolt | M8 | 8 | 11 | 1.1 | 8.0 | E |
| | 2nd | | | | 22 | 2.2 | 16 | |
| Air filter case – air filter case stay 1/ air filter case stay 2 | 1st | Bolt | M8 | 3 | 8.8 | 0.88 | 6.4 | LT 242 |
| | 2nd | | | | 18 | 1.8 | 13 | |
| Wire harness bracket 1/ sub wire harness – air filter case | 1st | Bolt | M6 | 2 | 3.8 | 0.38 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Fuel hose bracket/wire harness bracket 2 – air filter case | 1st | Bolt | M6 | 2 | 3.8 | 0.38 | 2.7 | LT 242 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Wire harness bracket 2 – air filter case | | Screw | M5 | 1 | 2.5 | 0.25 | 1.8 | LT 572 |
| Air filter case stay 1 – exhaust pipe 3 | 1st | Bolt | M8 | 2 | 15 | 1.5 | 11 | LT 271 |
| | 2nd | | | | 39 | 3.9 | 28 | |
| Air filter case stay 2 – cylinder head | 1st | Bolt | M8 | 1 | 15 | 1.5 | 11 | LT 271 |
| | 2nd | | | | 39 | 3.9 | 28 | |
| Fuel rail – throttle bodies | | Screw | M6 | 3 | 5.0 | 0.5 | 3.6 | |
| Intake air pressure sensor – bracket 1 | | Screw | M5 | 2 | 3.5 | 0.35 | 2.5 | |
| Intake air temperature sensor – bracket 1 | | Nut | — | 1 | 15 | 1.5 | 11 | |
| Bracket 1 – fuel rail | | Screw | M6 | 1 | 5.0 | 0.5 | 3.6 | |
| Fuel pipe – fuel rail | | Screw | M5 | 2 | 3.5 | 0.35 | 2.5 | |
| Bracket 2 – fuel rail | | Screw | M5 | 2 | 3.5 | 0.35 | 2.5 | |
| Throttle stop guide – throttle bodies | | Screw | M6 | 2 | 5.0 | 0.5 | 3.6 | |
| Throttle stop screw bracket – throttle bodies | | Screw | M6 | 2 | 5.0 | 0.5 | 3.6 | |
| Throttle position sensor – throttle bodies | | Screw | M4 | 2 | 2.0 | 0.2 | 1.4 | |

# TIGHTENING TORQUES



| Part to tightened | | Part name | Thread size | Q'ty | Tightening torque | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | N•m | kgf•m | ft•lb | |
| **Engine** | | | | | | | | |
| Engine unit – engine mount | | Bolt | M8 | 4 | 17 | 1.7 | 12 | LT 271 |
| Oil filter | | — | — | 1 | 17 | 1.7 | 12 | |
| Coupling cover | | Bolt | M6 | 1 | 7.8 | 0.78 | 5.6 | LT 572 |
| Thermoswitch (exhaust) – exhaust pipe 3 | | Bolt | M6 | 2 | 7.6 | 0.76 | 5.5 | LT 572 |
| Outer exhaust joint clamp – exhaust pipe 3/exhaust pipe 2 | 1st | — | — | 2 | 4.4 | 0.44 | 3.2 | |
| | 2nd | | | | 4.4 | 0.44 | 3.2 | |
| Inner exhaust joint clamp – exhaust pipe 3/exhaust pipe 2 | 1st | — | — | 2 | 4.4 | 0.44 | 3.2 | |
| | 2nd | | | | 4.4 | 0.44 | 3.2 | |
| Exhaust pipe 3 – crankcase | 1st | Bolt | M10 | 1 | 2.0 | 0.2 | 1.4 | LT 242 |
| | 5th | | | | 15 | 1.5 | 11 | |
| | 9th | | | | 39 | 3.9 | 28 | |
| | 2nd | Bolt | M10 | 1 | 2.0 | 0.2 | 1.4 | LT 242 |
| | 6th | | | | 15 | 1.5 | 11 | |
| | 10th | | | | 39 | 3.9 | 28 | |
| | 3rd | Bolt | M10 | 1 | 2.0 | 0.2 | 1.4 | LT 242 |
| | 7th | | | | 15 | 1.5 | 11 | |
| | 11th | | | | 39 | 3.9 | 28 | |
| | 4th | Bolt | M10 | 1 | 2.0 | 0.2 | 1.4 | LT 242 |
| | 8th | | | | 15 | 1.5 | 11 | |
| | 12th | | | | 39 | 3.9 | 28 | |
| Exhaust pipe end – exhaust pipe 3 | 1st | Bolt | M6 | 3 | 3.7 | 0.37 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Exhaust pipe stay – crankcase | 1st | Bolt | M8 | 2 | 15 | 1.5 | 11 | LT 242 |
| | 2nd | | | | 42 | 4.2 | 30 | |
| Exhaust pipe 1 – exhaust pipe stay | 1st | Bolt | M10 | 1 | 15 | 1.5 | 11 | LT 242 |
| | 2nd | | | | 42 | 4.2 | 30 | |
| Exhaust pipe 2 – exhaust pipe 1 | 1st | Nut | — | 1 | 39 | 3.9 | 28 | E |
| | 6th | | | | 39 | 3.9 | 28 | |
| | 2nd | Nut | — | 1 | 39 | 3.9 | 28 | |
| | 7th | | | | 39 | 3.9 | 28 | |
| | 3rd | Nut | — | 1 | 39 | 3.9 | 28 | |
| | 8th | | | | 39 | 3.9 | 28 | |
| | 4th | Nut | — | 1 | 39 | 3.9 | 28 | |
| | 9th | | | | 39 | 3.9 | 28 | |
| | 5th | Nut | — | 1 | 39 | 3.9 | 28 | |
| | 10th | | | | 39 | 3.9 | 28 | |
| Exhaust pipe 1 – exhaust manifold 1/ exhaust manifold 2 | 1st | Bolt | M8 | 10 | 22 | 2.2 | 16 | LT 242 |
| | 2nd | | | | 22 | 2.2 | 16 | |
| | 3rd | | | | 35 | 3.5 | 25 | |

# TIGHTENING TORQUES

| Part to tightened | | Part name | Thread size | Q'ty | Tightening torque | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | N•m | kgf•m | ft•lb | |
| Exhaust manifold 1 – cylinder head | 1st | Bolt | M8 | 6 | 22 | 2.2 | 16 | LT 242 |
| | 2nd | | | | 22 | 2.2 | 16 | |
| | 3rd | | | | 35 | 3.5 | 25 | |
| Exhaust manifold 2 – cylinder head | 1st | Bolt | M8 | 5 | 22 | 2.2 | 16 | LT 242 |
| | 2nd | | | | 22 | 2.2 | 16 | |
| | 3rd | | | | 35 | 3.5 | 25 | |
| Water jacket – oil tank | 1st | Bolt | M6 | 4 | 3.7 | 0.37 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Oil tank stay/reduction drive gear case – oil separator | 1st | Bolt | M6 | 3 | 3.7 | 0.37 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Cover (ground lead) – oil tank | | Bolt | M6 | 3 | 7.6 | 0.76 | 5.5 | LT 572 |
| Ground lead – oil tank | | Bolt | M6 | 2 | 7.6 | 0.76 | 5.5 | E |
| Oil tank – reduction drive gear case | 1st | Bolt | M8 | 4 | 15 | 1.5 | 11 | LT 572 |
| | 2nd | | | | 28 | 2.8 | 20 | |
| Oil tank – oil tank stay | 1st | Nut | — | 2 | 2.0 | 0.2 | 1.4 | LT 572 |
| | 2nd | | | | 15 | 1.5 | 11 | |
| | 3rd | | | | 39 | 3.9 | 28 | |
| Oil tank stay – cylinder head | 1st | Bolt | M10 | 2 | 2.0 | 0.2 | 1.4 | LT 572 |
| | 2nd | | | | 15 | 1.5 | 11 | |
| | 3rd | | | | 39 | 3.9 | 28 | |
| Bracket (coupling cover) – oil tank | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Hanger – oil tank cover | 1st | Bolt | M6 | 4 | 3.7 | 0.37 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Oil tank cover – oil tank | 1st | Bolt | M6 | 8 | 3.7 | 0.37 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Oil breather plate 1/ oil breather plate 2 – oil tank cover | 1st | Bolt | M5 | 10 | 1.9 | 0.19 | 1.4 | E |
| | 2nd | | | | 4.4 | 0.44 | 3.2 | |
| Baffle plate – oil tank | 1st | Bolt | M5 | 3 | 1.9 | 0.19 | 1.4 | E |
| | 2nd | | | | 4.4 | 0.44 | 3.2 | |
| Oil strainer – oil tank | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | E |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Oil cooler cover – oil tank | 1st | Bolt | M6 | 24 | 3.7 | 0.37 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Anode – oil tank | | Screw | M4 | 1 | 3.7 | 0.37 | 2.7 | E |
| Oil pump assembly – reduction drive gear case | 1st | Bolt | M6 | 12 | 1.4 | 0.14 | 1.0 | LT 572 |
| | 2nd | | | | 10 | 1.0 | 7.2 | |
| Drain plug (engine oil) | | Bolt | M8 | 1 | 18 | 1.8 | 13 | |
| Oil pump housing cover 1/oil pump housing – oil pump housing cover 2 | | Bolt | M6 | 2 | 7.9 | 0.79 | 5.7 | |
| Drive coupling – drive shaft | | — | — | 1 | 28 | 2.8 | 20 | LT 572 |

# TIGHTENING TORQUES



| Part to tightened | | Part name | Thread size | Q'ty | Tightening torque | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | N•m | kgf•m | ft•lb | |
| Reduction drive gear case – crankcase | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| | 1st | Bolt | M8 | 7 | 15 | 1.5 | 11 | LT 572 |
| | 2nd | | | | 28 | 2.8 | 20 | |
| Holder (relief valve) – reduction drive gear case | | Bolt | M6 | 1 | 10 | 1.0 | 7.2 | E |
| Bearing housing – reduction drive gear case | 1st | Bolt | M8 | 4 | 15 | 1.5 | 11 | E |
| | 2nd | | | | 28 | 2.8 | 20 | |
| Battery negative lead – starter motor | | Nut | — | 1 | 18 | 1.8 | 13 | A |
| Starter motor lead – starter motor | | Bolt | M8 | 1 | 4.9 | 0.49 | 3.5 | A |
| Starter motor – crankcase | | Bolt | M8 | 1 | 18 | 1.8 | 13 | |
| Generator cover – crankcase | 1st | Bolt | M10 | 8 | 15 | 1.5 | 11 | LT 572 |
| | 2nd | | | | 50 | 5.0 | 36 | |
| Rotor – crankshaft | | Bolt | M10 | 1 | 75 | 7.5 | 54 | E |
| Rotor – starter clutch | | Bolt | M8 | 6 | 24 | 2.4 | 17 | |
| Washer/pulser coil lead and lighting coil lead – generator | | Bolt | M5 | 3 | 4.9 | 0.49 | 3.5 | LT 242 |
| Pulser coil – generator cover | | Bolt | M5 | 4 | 4.9 | 0.49 | 3.5 | LT 242 |
| Holder (wire harness) – generator cover | | Bolt | M6 | 2 | 14 | 1.4 | 10 | LT 242 |
| Lighting coil – generator cover | | Bolt | M6 | 3 | 14 | 1.4 | 10 | LT 242 |
| Spark plug | | — | — | 4 | 13 | 1.3 | 9.4 | |
| Camshaft position sensor | | Bolt | M6 | 1 | 10 | 1.0 | 7.2 | LT 572 |
| Cooling water pipe – cylinder | 1st | Bolt | M6 | 1 | 3.7 | 0.37 | 2.7 | LT 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Cylinder head cover – cylinder head | | Bolt | M6 | 6 | 12 | 1.2 | 8.7 | E |
| Timing chain tensioner cap bolt | | Bolt | M6 | 1 | 10 | 1.0 | 7.2 | |
| Timing chain tensioner – cylinder head | | Bolt | M6 | 2 | 10 | 1.0 | 7.2 | |
| Exhaust camshaft cap – cylinder head | | Bolt | M6 | 10 | 10 | 1.0 | 7.2 | E |
| Intake camshaft cap – cylinder head | | Bolt | M6 | 18 | 10 | 1.0 | 7.2 | E |
| Exhaust camshaft sprocket – exhaust camshaft | | Bolt | M7 | 2 | 24 | 2.4 | 17 | E |
| Intake camshaft sprocket – intake camshaft | | Bolt | M7 | 2 | 24 | 2.4 | 17 | E |
| Hanger – cylinder head | | Bolt | M8 | 2 | 40 | 4.0 | 29 | LT 271 |
| Cylinder head – crankcase | | Bolt | M6 | 3 | 10 | 1.0 | 7.2 | E |
| | 1st | Nut | — | 2 | 20 | 2.0 | 14 | |
| | 2nd | | | | 64 | 6.4 | 46 | |
| | 1st | Nut | — | 8 | 20 | 2.0 | 14 | |
| | 2nd | | | | 49 | 4.9 | 35 | |

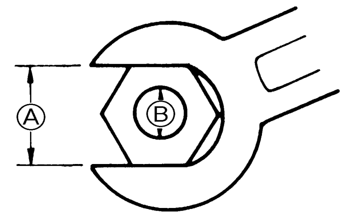
| Part to tightened | | Part name | Thread size | Q'ty | Tightening torque | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | N•m | kgf•m | ft•lb | |
| Plug (vacuum pressure) | | Bolt | M6 | 4 | 10 | 1.0 | 7.2 | |
| Engine temperature sensor – crankcase | | — | — | 1 | 15 | 1.5 | 11 | |
| Thermoswitch (engine) – crankcase | | Bolt | M6 | 2 | 7.6 | 0.76 | 5.5 | 572 |
| Oil pressure switch | | — | — | 1 | 8.4 | 0.84 | 6.1 | 572 |
| Anode cover – anode | | Bolt | M6 | 1 | 12 | 1.2 | 8.7 | 271 |
| Anode cover – cylinder head | | Bolt | M8 | 1 | 20 | 2.0 | 14 | |
| Oil pan – lower crankcase | | Bolt | M6 | 13 | 12 | 1.2 | 8.7 | 572 |
| Lower crankcase – upper crankcase | | Bolt | M6 | 10 | 12 | 1.2 | 8.7 | 572 |
| | 1st | Bolt | M9 | 10 | 7.8 | 0.78 | 5.6 | E |
| | 2nd | | | | 15 | 1.5 | 11 | |
| | 3rd | | | | 49 ± 5° | | | |
| Oil pipe – lower crankcase | | Bolt | M6 | 1 | 12 | 1.2 | 8.7 | E |
| Cover – lower crankcase | | Screw | M6 | 2 | 12 | 1.2 | 8.7 | 572 |
| Oil filter bolt – lower crankcase | | — | — | 1 | 35 | 3.5 | 25 | E |
| Connecting rod cap | 1st | Nut | — | 8 | 20 | 2.0 | 14 | |
| | 2nd | | | | 120 ± 5° | | | |
| Thermostat housing cover – Thermostat housing | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Pressure control valve – upper crankcase | 1st | Bolt | M6 | 3 | 3.7 | 0.37 | 2.7 | 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| Collar/pressure control valve housing cover – pressure control housing | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | 572 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | |
| **Jet pump unit** | | | | | | | | |
| Steering cable joint – jet thrust nozzle | | Nut | — | 1 | 6.8 | 0.68 | 4.9 | 242 |
| Ride plate – hull | | Bolt | M8 | 4 | 17 | 1.7 | 12 | 572 |
| Intake duct – hull | | Bolt | M8 | 4 | 20 | 2.0 | 14 | 242 |
| Intake grate – hull | | Bolt | M6 | 4 | 7.8 | 0.78 | 5.6 | 242 |
| Speed sensor – ride plate | | Screw | M5 | 4 | 3.7 | 0.37 | 2.7 | 242 |
| Jet pump unit assembly/impeller housing 2 – transom | | Bolt | M10 | 4 | 40 | 4.0 | 29 | 572 |
| | | Bolt | M6 | 1 | 7.8 | 0.78 | 5.6 | |
| Rubber plate – bracket | | Bolt | M6 | 4 | 6.8 | 0.68 | 4.9 | |
| Roller – reverse gate stay | | Bolt | M8 | 1 | 8.3 | 0.83 | 6.0 | 271 |
| | | Nut | — | 1 | 26 | 2.6 | 19 | |
| Reverse gate stay – jet pump | | Bolt | M6 | 6 | 7.8 | 0.78 | 5.6 | 242 |
| Reverse gate – reverse gate stay | | Bolt | M8 | 2 | 20 | 2.0 | 14 | 242 |
| Lever 1 – Reverse gate stay | | Bolt | M6 | 1 | 7.8 | 0.78 | 5.6 | 242 |
| Lever 2– Reverse gate stay | | Nut | — | 1 | 7.8 | 0.78 | 5.6 | 242 |
| Nozzle ring – nozzle | | Bolt | M8 | 2 | 15 | 1.5 | 11 | 271 |
| Jet thrust nozzle – nozzle ring | | Bolt | M8 | 2 | 15 | 1.5 | 11 | 271 |
| Nozzle/impeller duct assembly – impeller housing 1 | | Bolt | M10 | 4 | 40 | 4.0 | 29 | 572 |

| Part to tightened | Part name | Thread size | Q'ty | Tightening torque | | | Remarks |
|---|---|---|---|---|---|---|---|
| | | | | N•m | kgf•m | ft•lb | |
| Water inlet cover/water inlet strainer – impeller duct | Bolt | M6 | 4 | 6.6 | 0.66 | 4.8 | LT 572 |
| Drive shaft nut – drive shaft | Nut | — | 1 | 69 | 6.9 | 50 | |
| Impeller (left-hand threads) – drive shaft | Impeller | M22 | 1 | 27 | 2.7 | 19 | LT 572 |
| Transom plate – hull | Nut | — | 4 | 26 | 2.6 | 19 | |
| Bilge strainer holder – bulkhead | Screw | M5 | 1 | 3.7 | 0.37 | 2.8 | |
| Intermediate housing – bulkhead | Bolt | M8 | 3 | 17 | 1.7 | 12 | LT 572 |
| Driven coupling – shaft | Driven coupling | M24 | 1 | 36 | 3.6 | 25 | LT 572 |
| Grease nipple – intermediate housing | Nipple | — | 1 | 5.4 | 0.54 | 3.9 | LT 572 |
| **Hull and hood** | | | | | | | |
| Handlebar holder – steering master | Bolt | M8 | 4 | 20 | 2.0 | 14 | LT 242 |
| Handlebar cover stay – steering master | Bolt | M6 | 2 | 1.1 | 0.11 | 0.8 | LT 271 |
| Handlebar cover – handlebar cover stay | Screw | M6 | 4 | 1.1 | 0.11 | 0.8 | LT 242 |
| Handle boss cover – steering master | Screw | M6 | 4 | 0.9 | 0.09 | 0.7 | LT 242 |
| QSTS converter – hull | Nut | — | 2 | 5.4 | 0.54 | 3.9 | |
| Throttle lever assembly – handlebar | Screw | M5 | 2 | 3 | 0.3 | 2.2 | |
| Handlebar switch assembly – handlebar | Screw | M5 | 2 | 3.4 | 0.34 | 2.5 | |
| QSTS grip assembly – handlebar | Screw | M6 | 1 | 3.4 | 0.34 | 2.5 | |
| Grip end – handlebar | Bolt | M5 | 2 | 1.2 | 0.12 | 0.9 | LT 242 |
| Cable housing – QSTS grip assembly | Screw | M4 | 1 | 1 | 0.1 | 0.7 | |
| Steering master – deck | Nut | — | 4 | 20 | 2.0 | 14 | |
| Steering cable ball joint – steering arm | Nut | — | 1 | 6.8 | 0.68 | 4.9 | |
| QSTS cable locknut (QSTS converter side) | Nut | — | 1 | 3 | 0.3 | 2.2 | |
| QSTS cable locknut (nozzle ring side) | Nut | — | 1 | 3.8 | 0.38 | 2.7 | |
| QSTS cable grommet – hull | Nut | — | 1 | 5.9 | 0.59 | 4.3 | |
| QSTS cable end pin – QSTS converter | Nut | — | 1 | 3.8 | 0.38 | 2.7 | |
| Shift cable locknut (reverse gate side) | Nut | — | 1 | 2.9 | 0.29 | 2.1 | |
| Shift cable grommet – hull | Nut | — | 1 | 5.9 | 0.59 | 4.3 | |
| Shift cable holder – shift lever base | Nut | — | 2 | 5.4 | 0.54 | 3.9 | |
| Steering cable locknut (steering arm side) | Nut | — | 1 | 6.4 | 0.64 | 4.6 | |

| Part to tightened | Part name | Thread size | Q'ty | Tightening torque N•m | kgf•m | ft•lb | Remarks |
|---|---|---|---|---|---|---|---|
| Steering cable locknut (jet thrust nozzle side) | Nut | — | 1 | 6.5 | 0.65 | 4.7 | |
| Steering cable grommet – hull | Nut | — | 1 | 5.9 | 0.59 | 4.3 | |
| Steering cable bracket – steering cable holder | Nut | — | 2 | 5.4 | 0.54 | 3.9 | |
| Steering cable bracket – deck | Nut | — | 2 | 5.4 | 0.54 | 3.9 | |
| Speed sensor lead grommet – hull | Nut | — | 1 | 5.9 | 0.59 | 4.3 | |
| Front hood assembly – deck | Nut | — | 4 | 5.4 | 0.54 | 3.9 | |
| Service lid 1 – deck | Bolt | M6 | 4 | 5.4 | 0.54 | 3.9 | 271 |
| Service lid 2– deck | Screw | M4 | 4 | 1.5 | 0.15 | 1.1 | |
| Panel – steering console cover | Bolt | M5 | 4 | 3.9 | 0.39 | 2.8 | 242 |
| Multifunction meter – steering console cover | Bolt | M5 | 4 | 3.9 | 0.39 | 2.8 | 242 |
| Mirror – steering console cover | Nut | — | 4 | 6.9 | 0.69 | 5.0 | |
| Side cover – deck | Bolt | M6 | 8 | 5.4 | 0.54 | 3.9 | 271 |
| Bracket (side cover) – deck | Bolt | M6 | 4 | 5.4 | 0.54 | 3.9 | |
| Steering console cover – glove box | Bolt | M6 | 2 | 5.4 | 0.54 | 3.9 | 242 |
| Hood lock assembly | Bolt | M6 | 2 | 5.4 | 0.54 | 3.9 | |
| Steering console cover – deck | Nut | — | 2 | 5.4 | 0.54 | 3.9 | |
| Glove compartment – deck | Nut | — | 2 | 20 | 2.0 | 14 | |
| Shift lever handle – shift lever | Bolt | M6 | 2 | 5.4 | 0.54 | 3.9 | 271 |
| Latch – glove compartment | Screw | M6 | 2 | 5.4 | 0.54 | 3.9 | 271 |
| Pilot water outlet – hull | Nut | — | 2 | 4.2 | 0.42 | 3.0 | |
| Shift lever plate – deck | Screw | M6 | 3 | 5.4 | 0.54 | 3.9 | |
| Shift lever plate – deck/shift lever base assembly | Screw | M6 | 3 | 5.4 | 0.54 | 3.9 | 242 |
| Shift lever – base assembly | Bolt | M6 | 1 | 5.4 | 0.54 | 3.9 | 271 |
| Hand grip – deck | Nut | — | 4 | 5.2 | 0.52 | 3.8 | |
| Front seat stay – deck | Nut | — | 2 | 15 | 1.5 | 11 | |
| Seat lock projection – deck beam | Nut | — | 1 | 26 | 2.6 | 19 | |
| Seat lock projection – deck | Nut | — | 1 | 26 | 2.6 | 19 | |
| Rear seat stay – deck | Nut | — | 4 | 5.2 | 0.52 | 3.8 | |
| Seat lock assembly – seat | Bolt | M6 | 4 | 6.4 | 0.64 | 4.6 | 271 |
| Deck beam – deck | Nut | — | 4 | 18 | 1.8 | 13 | |
| Plate/rubber hose/exhaust valve – hull | Nut | — | 6 | 5.4 | 0.54 | 3.9 | |
| Exhaust joint protector 1 – Exhaust joint protector 2 — 1st | Bolt | M6 | 6 | 3.7 | 0.37 | 2.7 | 572 |
| 2nd | | | | 12 | 1.2 | 8.8 | |
| Sponson – hull | Bolt | M8 | 10 | 16 | 1.6 | 12 | |
| Cleat – deck | Nut | — | 2 | 15 | 1.5 | 11 | |
| Cleat – hull | Nut | — | 4 | 15 | 1.5 | 11 | |
| Spout – hull | Nut | — | 1 | 5.4 | 0.54 | 3.9 | |
| Protector (bow) – hull | Bolt | M6 | 4 | 5.4 | 0.54 | 3.9 | 271 |
| | Nut | — | 3 | 5.4 | 0.54 | 3.9 | |

| Part to tightened | Part name | Thread size | Q'ty | Tightening torque | | | Remarks |
|---|---|---|---|---|---|---|---|
| | | | | N•m | kgf•m | ft•lb | |
| Bow eye – hull | Bolt | M6 | 2 | 13 | 1.3 | 9.4 | |
| Drain plug/packing – hull | Bolt | M5 | 4 | 2.0 | 0.2 | 1.4 | |
| Engine mount – hull | Bolt | M8 | 8 | 17 | 1.7 | 12 | LT 572 |
| Engine damper – hull | Bolt | M6 | 4 | 6.4 | 0.64 | 4.6 | LT 271 |
| **Electrical** | | | | | | | |
| Battery box – hull | Bolt | M6 | 2 | 5.4 | 0.54 | 3.9 | LT 572 |
| Battery box/spacer – hull | Bolt | M6 | 2 | 5.4 | 0.54 | 3.9 | LT 271 |
| Electrical box – bulk head | Bolt | M8 | 4 | 17 | 1.7 | 12 | LT 572 |
| Terminal cover – electrical box | Screw | M5 | 4 | 4.9 | 0.49 | 3.5 | |
| Cover – electrical box | Tapping screw | ø5 | 18 | 4.9 | 0.49 | 3.5 | |
| Starter motor lead– electrical box | Screw | M6 | 1 | 7.6 | 0.76 | 5.5 | A |
| Battery positive lead – electrical box | Screw | M6 | 1 | 7.6 | 0.76 | 5.5 | A |
| Fuse holder stay – electrical box | Tapping screw | ø6 | 1 | 3.9 | 0.39 | 2.8 | |
| ECM – electrical box | Tapping screw | ø6 | 4 | 3.9 | 0.39 | 2.8 | |
| Bracket (coupler) – electrical box | Tapping screw | ø6 | 1 | 3.9 | 0.39 | 2.8 | |
| Slant detection switch – electrical box | Tapping screw | ø6 | 2 | 3.9 | 0.39 | 2.8 | |
| Main and fuel pump relay | Tapping screw | ø6 | 1 | 3.9 | 0.39 | 2.8 | |
| Rectifier/regulator | Tapping screw | ø6 | 2 | 3.9 | 0.39 | 2.8 | |
| Ignition coil – oil tank | Bolt | M6 | 3 | 7.6 | 0.76 | 5.5 | |
| Ignition coil cover – ignition coil case | Tapping screw | ø6 | 10 | 4.9 | 0.49 | 3.5 | |
| Ignition coil – ignition coil case | Tapping screw | ø6 | 4 | 4.9 | 0.49 | 3.5 | |

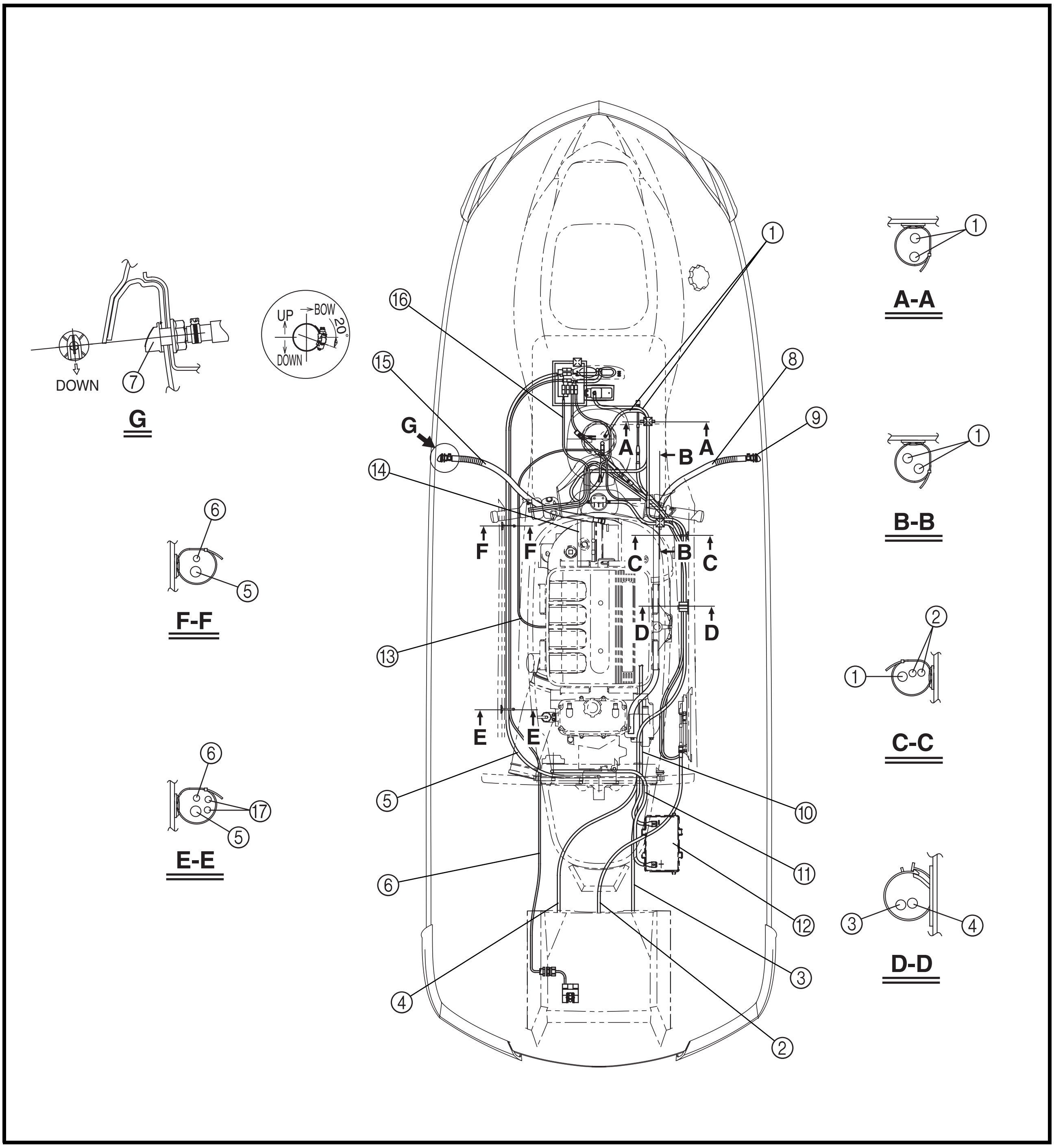
| Nut Ⓐ | Bolt Ⓑ | General torque specifications | | |
|---|---|---|---|---|
| | | N•m | kgf•m | ft•lb |
| 8 mm | M5 | 5.0 | 0.5 | 3.6 |
| 10 mm | M6 | 8.0 | 0.8 | 5.8 |
| 12 mm | M8 | 18 | 1.8 | 13 |
| 14 mm | M10 | 36 | 3.6 | 25 |
| 17 mm | M12 | 43 | 4.3 | 31 |



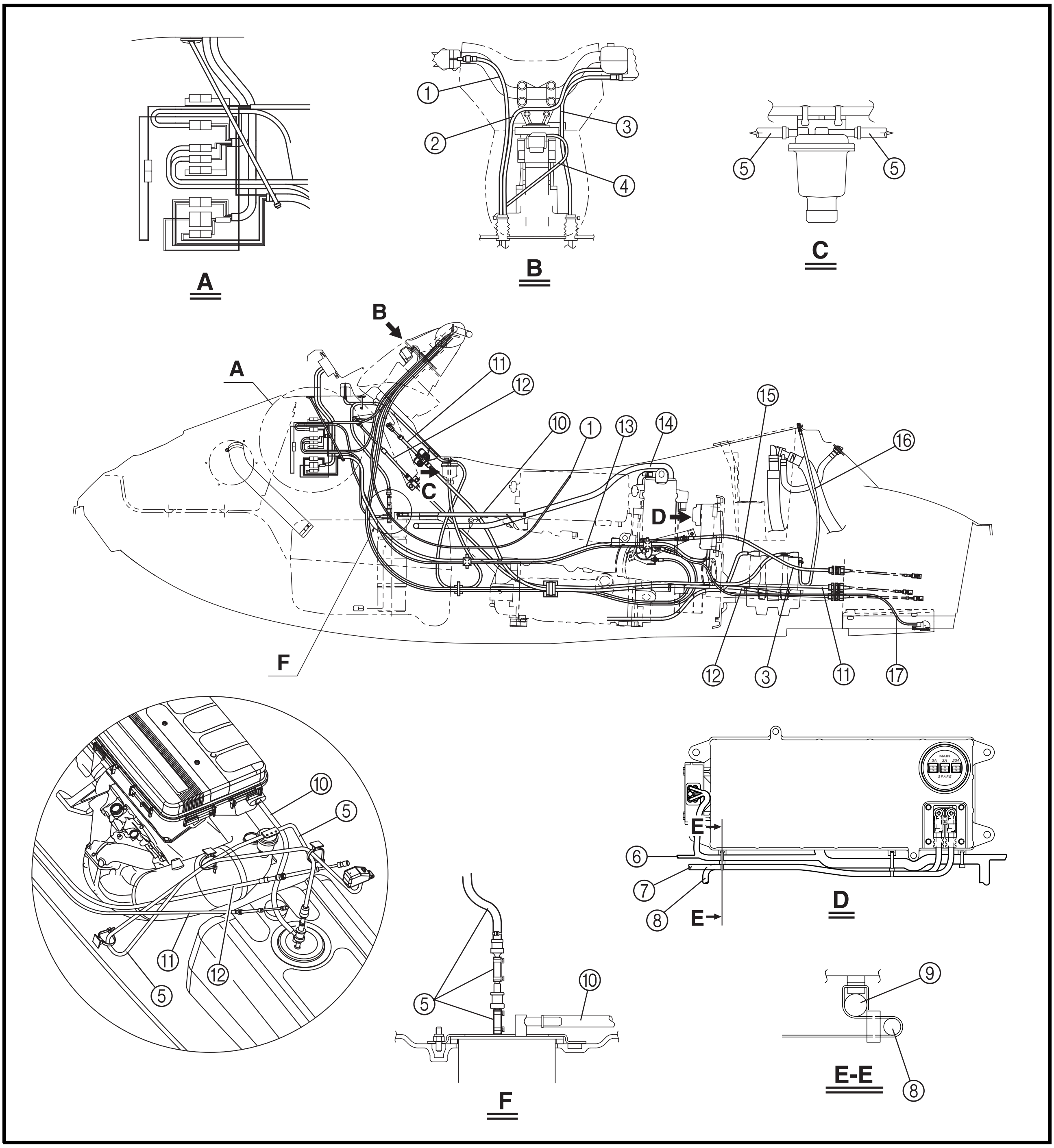

## GENERAL TORQUE

This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications for special components or assemblies are provided in applicable sections of this manual. To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified tightening torque is reached. Unless otherwise specified, tightening torque specifications require clean, dry threads.
Components should be at room temperature.

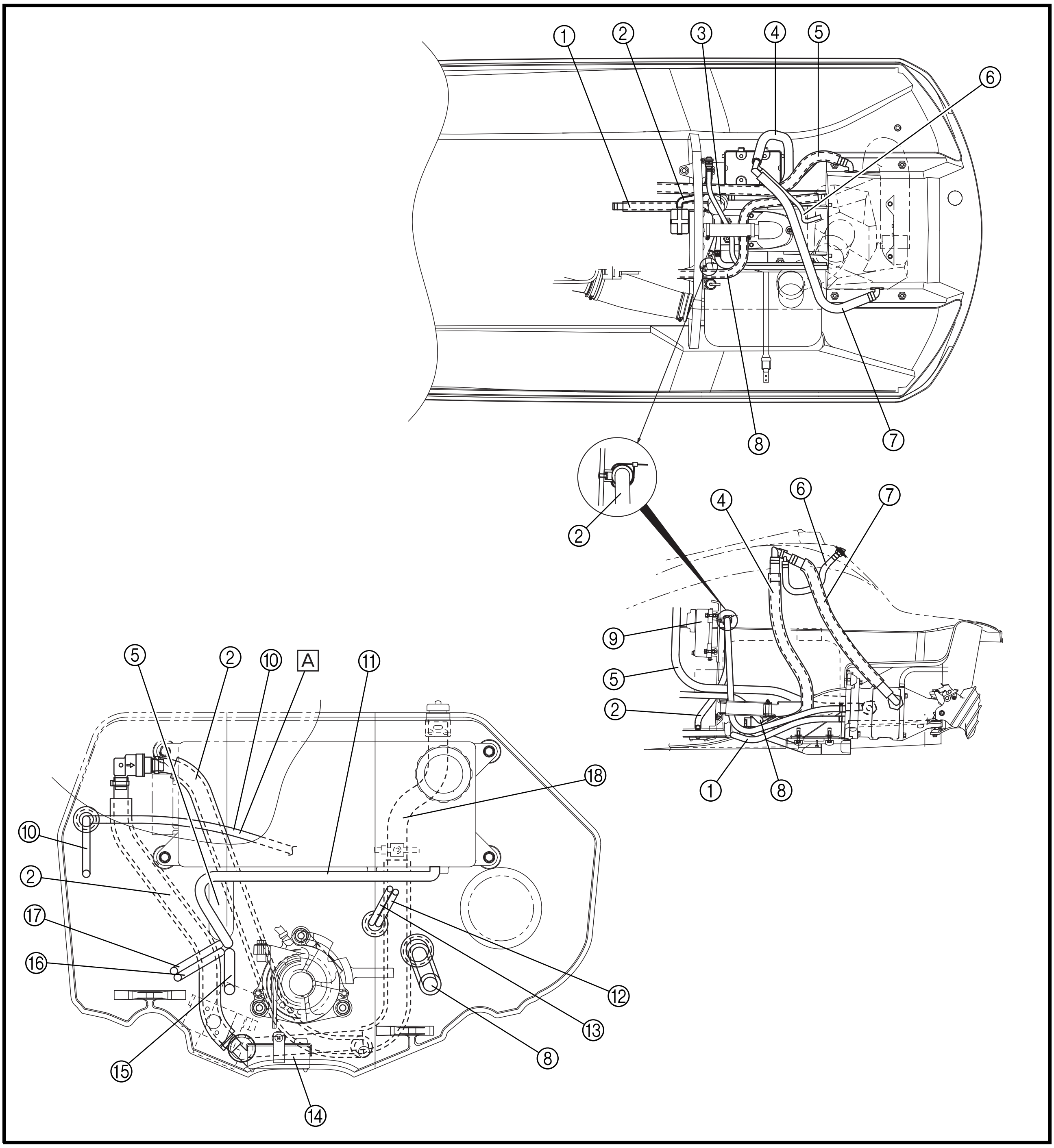
# CABLE AND HOSE ROUTING




① Fuel tank breather hose
② QSTS cable
③ Steering cable
④ Shift cable
⑤ Electrical box lead
⑥ Speed sensor lead
⑦ Cooling water pilot outlet
⑧ Cooling water pilot outlet hose
⑨ Cooling water pilot outlet
⑩ Battery negative lead
⑪ Battery positive lead
⑫ Battery
⑬ Throttle cable
⑭ Fuel hose
⑮ Cooling water pilot outlet hose
⑯ Handlebar switch lead
⑰ Electrical bilge pump lead

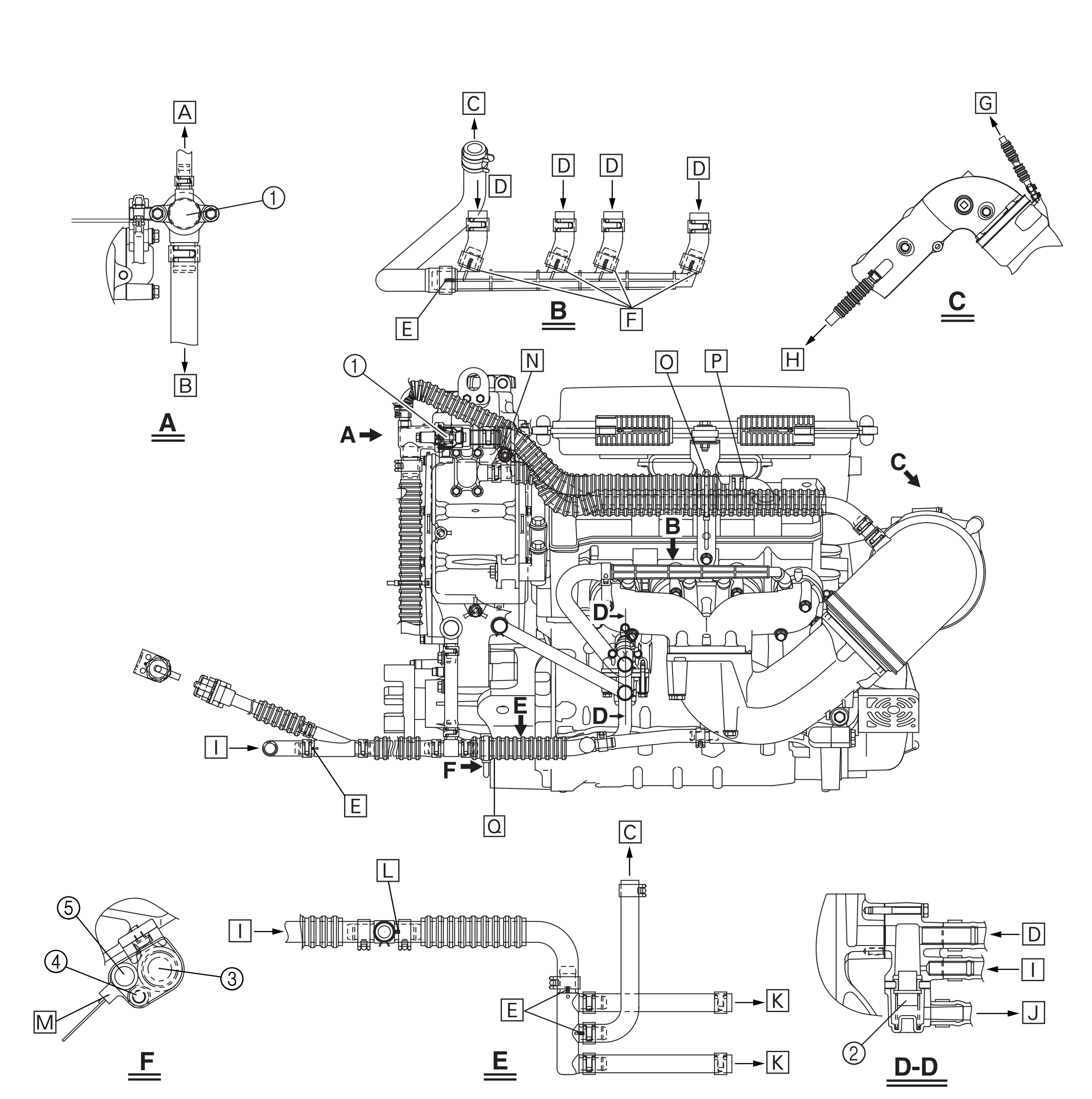



① Throttle cable
② Handlebar switch lead
③ QSTS cable
④ Buzzer lead
⑤ Fuel tank breather hose
⑥ Ignition coil lead
⑦ Battery positive lead
⑧ Starter motor lead
⑨ Wire harness
⑩ Fuel hose
⑪ Shift cable
⑫ Steering cable
⑬ Electrical box lead
⑭ Cooling water pilot outlet hose
⑮ Battery negative lead
⑯ Battery breather hose
⑰ Speed sensor lead



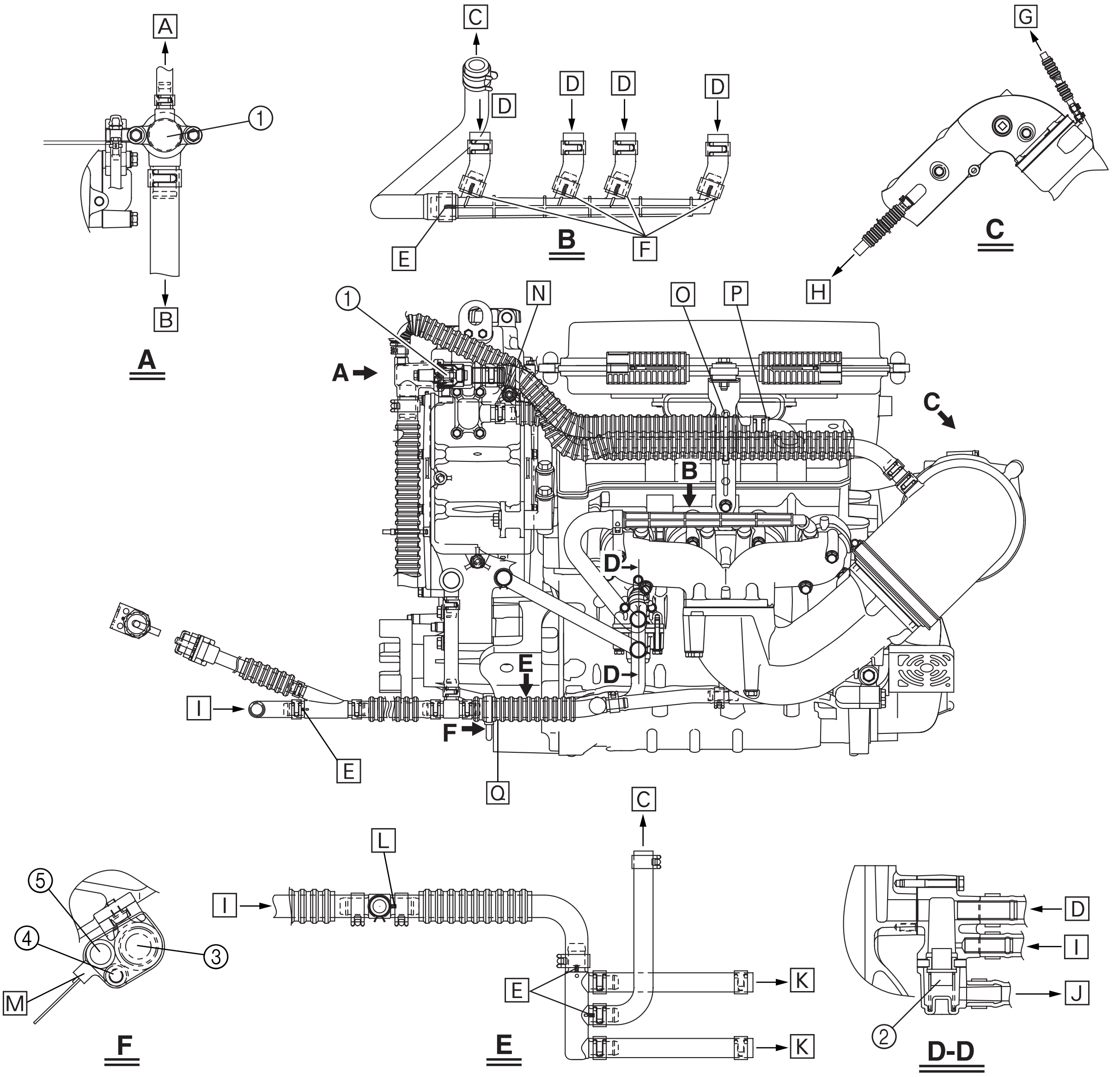

① Cooling water hose (cooling water inlet)
② Bilge hose 1
③ Electric bilge pump
④ Bilge hose 4
⑤ Cooling water hose (from thermostat)
⑥ Bilge hose 3
⑦ Bilge hose 2
⑧ Cooling water hose (from exhaust pipe)
⑨ Electrical box
⑩ QSTS cable
⑪ Battery positive lead
⑫ Speed sensor lead
⑬ Electric bilge pump lead
⑭ Bilge strainer
⑮ Battery negative lead
⑯ Steering cable
⑰ Shift cable
⑱ Flushing hose

A Pass the QSTS cable between in bilge hose.

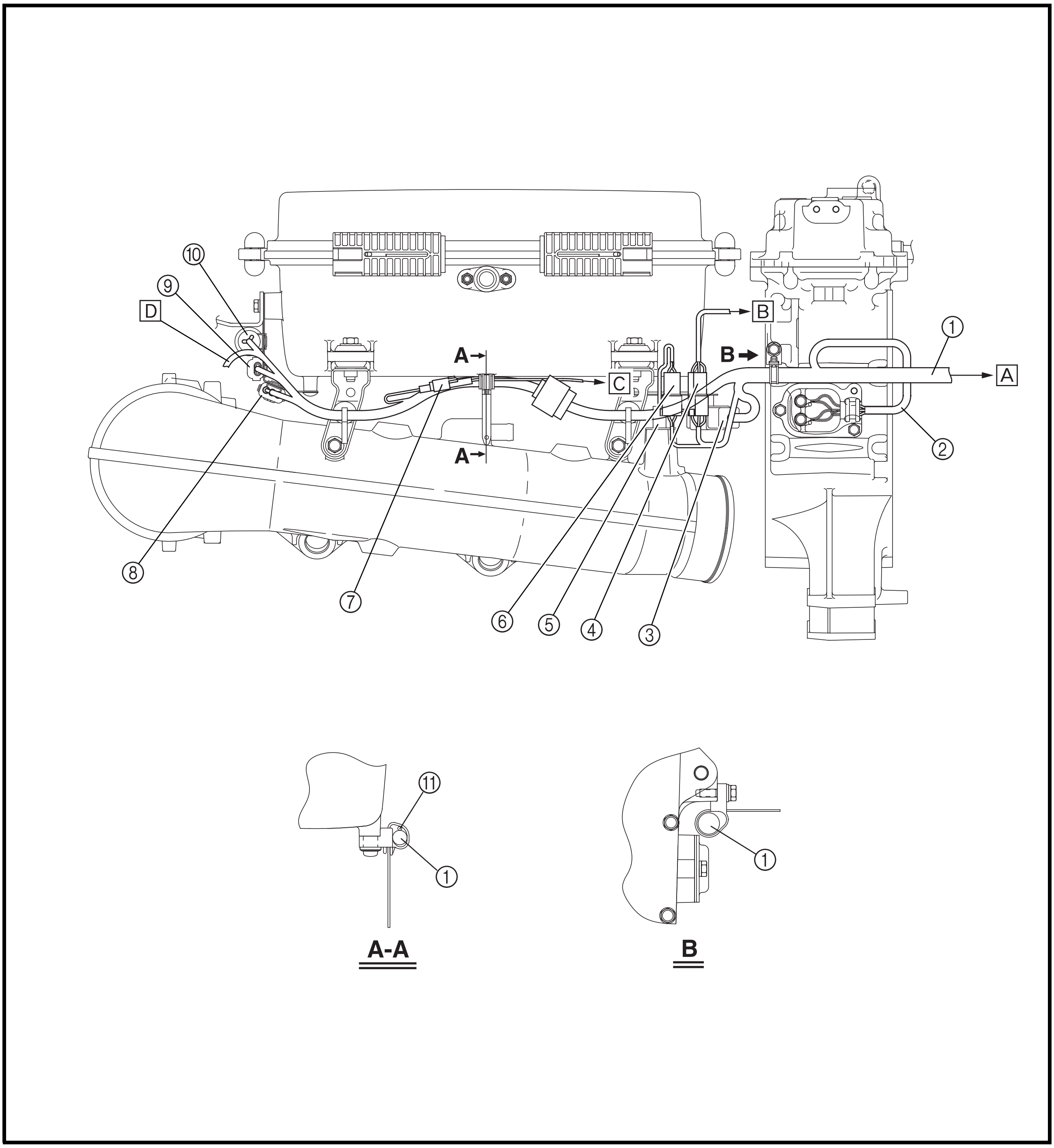



① Thermostat
② Pressure control valve
③ Cooling water hose (cooling water inlet)
④ Battery negative lead
⑤ Breather hose

A To cooling water pilot outlet on starboard side
B To cooling water outlet on starboard side of stern
C To pressure control valve
D From exhaust manifold
E To install the hose, align the white paint mark on the cooling water hose with the projection of hose joint.
F Insert the cooling water hose until it contacts the joint.
G To cooling water pilot outlet on port side
H To cooling water outlet at stern
I Cooling water inlet
J To oil tank

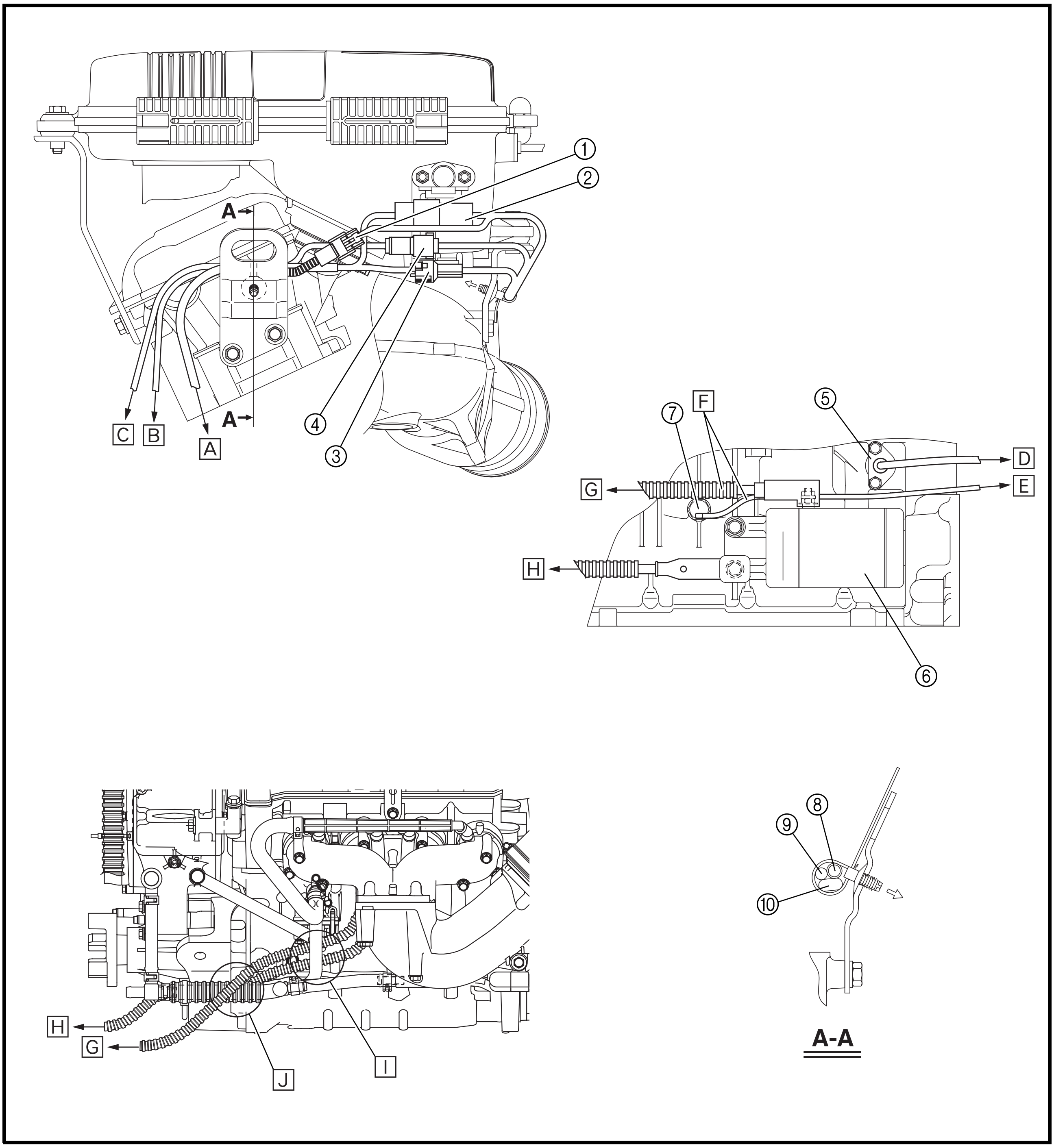



K To exhaust pipe
L To install the hose, align the white paint mark on the cooling water hose with the parting line on the hose joint.
M Fasten the cooling water hose and battery negative lead. Slide the tie in the direction shown.
N Bundle the cooling water pilot outlet hose and cooling water hose, and then fasten them together with the oil tank boss with a plastic locking tie.
O Bundle the cooling water pilot outlet hose and the cooling water hoses, pass a plastic locking tie through the stay hole, and then fasten the tie.
P Insert the cooling water hose to the paint mark.
Q Fasten the cooling water hose tube contacting the hose joint.

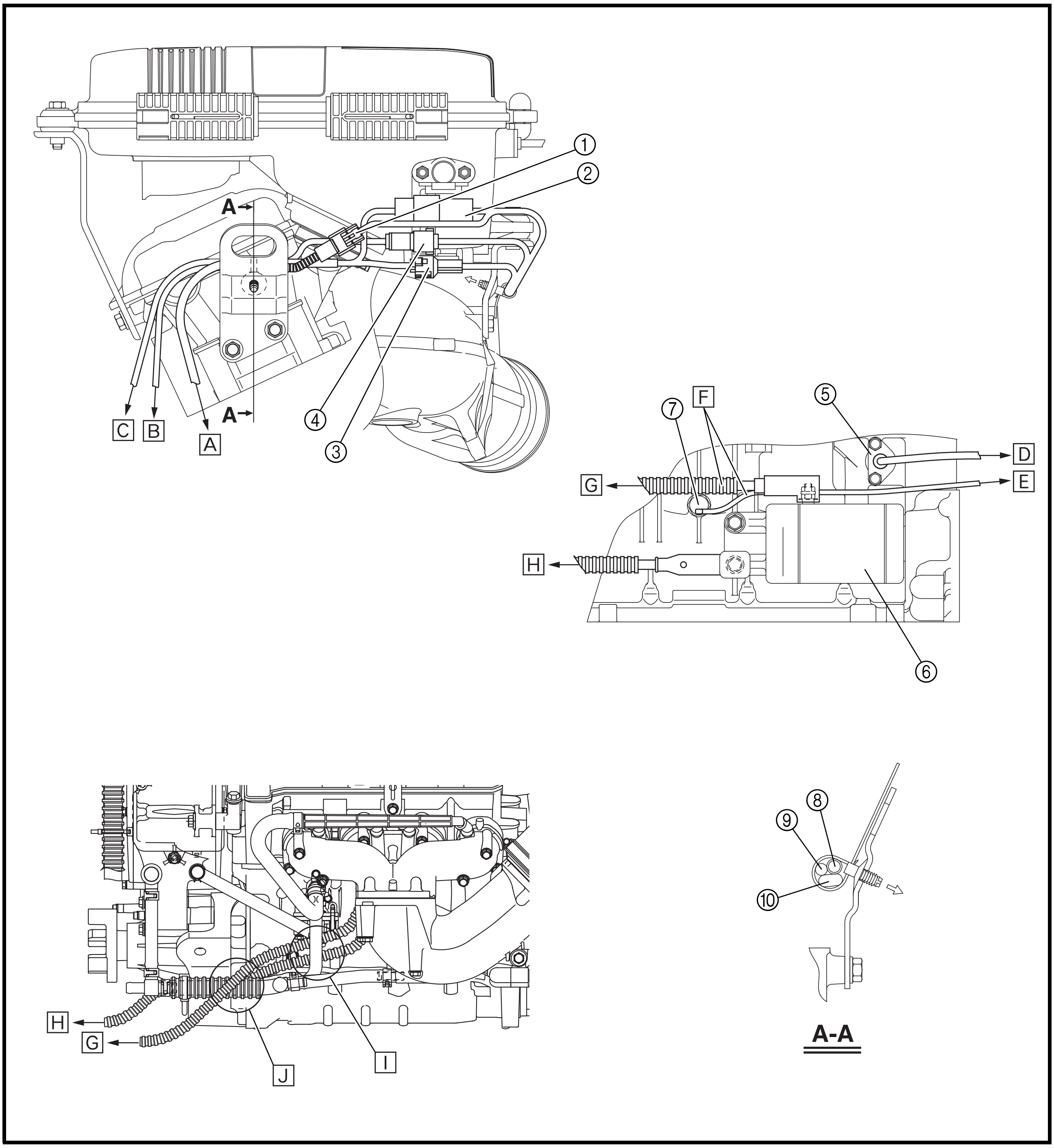



① Wire harness
② Ground lead
③ Wire harness coupler
④ Cam position sensor coupler
⑤ Thermoswitch (exhaust)
⑥ Thermoswitch (exhaust) coupler
⑦ Oil pressure switch coupler
⑧ Pulser coil coupler
⑨ Thermoswitch (engine) coupler
⑩ Lighting coil coupler
⑪ Oil pressure switch lead

A To electrical box
B To cam position sensor
C To oil pressure switch
D To engine temperature sensor




① Engine temperature sensor coupler
② Lighting coil coupler
③ Pulser coil coupler
④ Thermoswitch (engine) coupler
⑤ Thermoswitch (engine)
⑥ Starter motor
⑦ Engine temperature sensor
⑧ Engine temperature sensor lead
⑨ Thermoswitch (engine) lead
⑩ Lighting coil lead




A To generator
B To engine temperature sensor
C To thermoswitch (engine)
D To thermoswitch (engine) coupler
E To engine temperature sensor coupler
F Route the starter motor lead to the outside of the engine temperature sensor.
G To starter relay
H To battery negative terminal
I Route the starter motor and battery negative leads behind the cooling water hose.
J Route the starter motor lead over the cooling water hose.

# CHAPTER 3
# PERIODIC INSPECTION AND ADJUSTMENT

## MAINTENANCE INTERVAL CHART

The following chart should be considered strictly as a guide to general maintenance intervals. Depending on operating conditions, the intervals of maintenance should be changed.

(●) This mark indicates maintenance that you may do yourself.

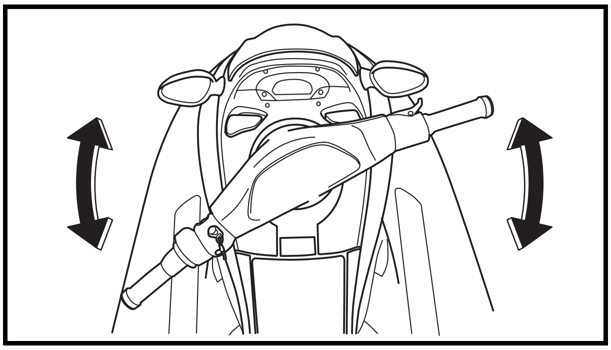
(❍) This mark indicates work to be done by a Yamaha dealer.

| ITEM | MAINTENANCE INTERVAL | INITIAL | | | THEREAFTER EVERY | | PAGE |
|---|---|---|---|---|---|---|---|
| | | 10 hours | 50 hours | 100 hours | 100 hours | 200 hours | |
| | | | 6 months | 12 months | 12 months | 24 months | |
| Spark plug | Inspect, clean, adjust | ● | ● | ● | ● | | 3-21 |
| Lubrication points | Lubricate | | | ● | ● | | 3-29 |
| Intermediate housing | Lubricate | ❍*1 | | ●*2 | ●*2 | | 3-31 |
| Fuel system | Inspect | | | ❍ | ❍ | | 3-9 |
| Fuel tank | Clean | | | ❍ | ❍ | | 3-9 |
| Fuel filter | Inspect, clean | | | ❍ | ❍ | | 3-9 |
| Trolling speed | Inspect | ❍ | | ❍ | ❍ | | 3-8 |
| Throttle shaft | Inspect | | | ❍ | ❍ | | — |
| Cooling water passages | Flush | ● (after every use) | | | | | — |
| Water inlet strainer | Inspect, clean | | | ❍ | ❍ | | 3-27 |
| Bilge strainer | Clean | | | ❍ | ❍ | | 3-27 |
| Electric bilge pump strainer | Inspect, clean | | | ❍ | ❍ | | 3-28 |
| Impeller | Inspect | | ● | ● | ● | | 3-26 |
| Steering cable | Inspect | | ● | ● | ● | | 3-2 |
| Steering master | Inspect | ❍ | | ❍ | ❍ | | 3-2 |
| QSTS mechanism | Inspect, adjust | ● (before every use) | | ❍ | ❍ | | 3-5 |
| Shift cable and mechanism | Inspect, adjust | | | ❍ | ❍ | | 3-7 |
| Throttle cable | Inspect, adjust | | | ● | ● | | 3-3 |
| Stern drain plugs | Inspect, replace | | | ❍ | ❍ | | 3-28 |
| Battery | Inspect | ● (inspect fluid level before every use) | | ❍ | ❍ | | 3-23 |
| Rubber coupling | Inspect | | | | | ❍ | — |
| Engine mount | Inspect | | | | | ❍ | 5-7 |
| Nuts and bolts | Inspect | ❍ | | ❍ | ❍ | | — |
| Air filter | Inspect | | | | | ● | 3-20 |
| Engine oil | Replace | ❍ | | ❍ | ❍ | | 3-18 |
| Engine oil filter | Replace | | | | | ❍ | 3-18 |
| Valve clearance | Inspect, adjust | | | | | ❍ | 3-10 |

*1: Grease capacity: 33.0–35.0 $cm^3$ (1.11–1.18 oz)

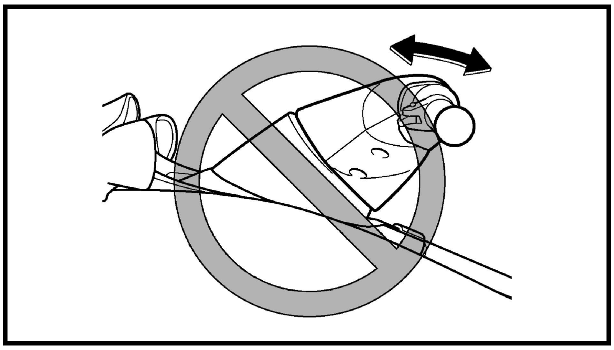
*2: Grease capacity: 6.0–8.0 $cm^3$ (0.20–0.27 oz)

# PERIODIC SERVICE
## CONTROL SYSTEM
### Steering master inspection

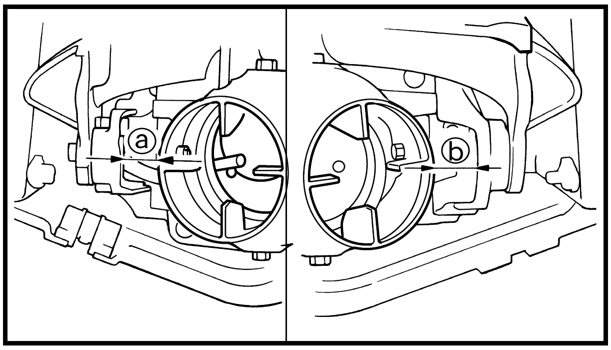


1. Inspect:
   - Steering master
     Excessive play → Replace the steering master.
     Refer to “STEERING MASTER” in Chapter 8.

**Inspection steps:**
- Move the handlebar up and down and back and forth.
- Check the excessive play of the handlebar.



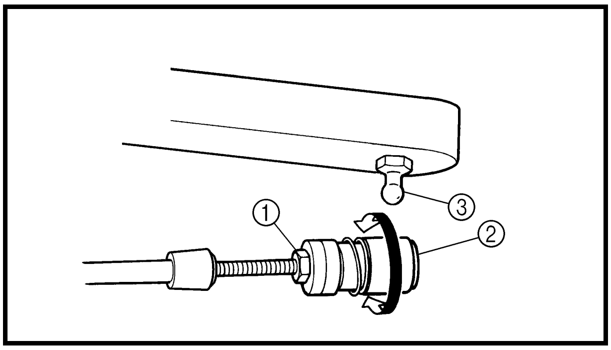
### Steering cable inspection and adjustment




1. Inspect:
   - Jet thrust nozzle clearance ⓐ, ⓑ
     Difference → Adjust.

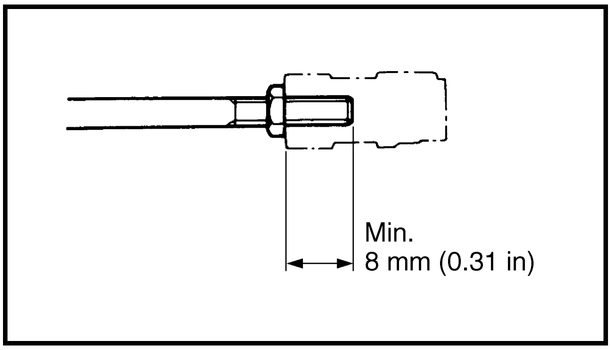
**Inspection steps:**
- Set the control grip in the neutral position.
- Turn the handlebar from lock to lock.
- Measure clearances ⓐ and ⓑ.
- If clearances ⓐ and ⓑ are not the same, adjust them.

2. Adjust:
   - Steering cable joint
     (steering master end)




**Adjustment steps:**
- Set the control grip in the neutral position.
- Loosen the locknut ①.
- Disconnect the steering cable joint ② from the ball joint ③.
- Turn the cable joint in or out for adjusting the clearance.

| | |
|---|---|
| **Turn in** | **Clearance ⓐ is increased.** |
| **Turn out** | **Clearance ⓑ is increased.** |




**⚠ WARNING**

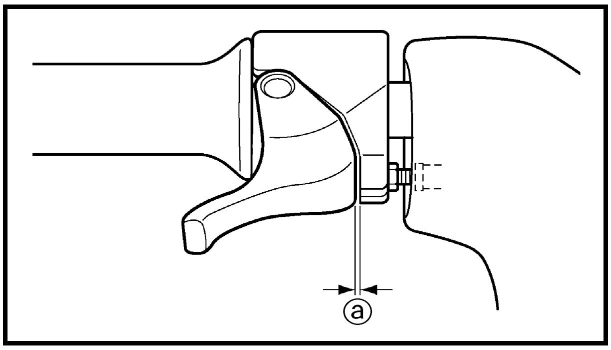
**The cable joint must be screwed in more than 8 mm (0.31 in).**

- Connect the cable joint and tighten the locknut.

| | |
|---|---|
| | **Locknut:** **6.4 N • m (0.64 kgf • m, 4.6 ft • lb)** |

**NOTE:**

If the steering cable cannot be properly adjusted by the cable joint at the steering master end, adjust the cable joint at the jet pump end so that the same clearances are obtained. Refer to "REMOTE CONTROL CABLES AND SPEED SENSOR LEAD" in Chapter 8.



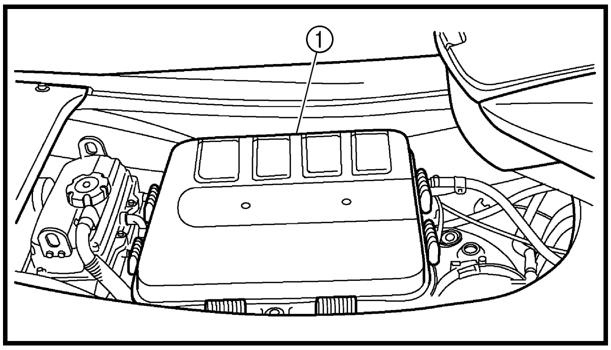

**Throttle cable inspection and adjustment**

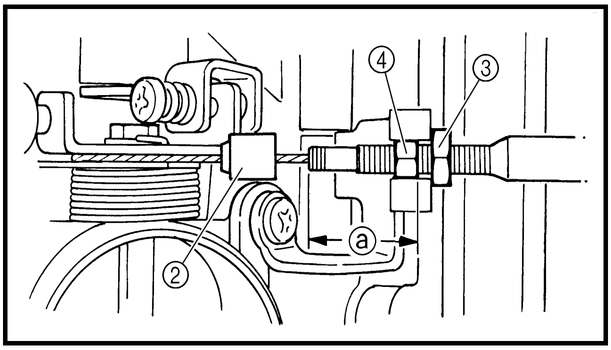
**NOTE:**

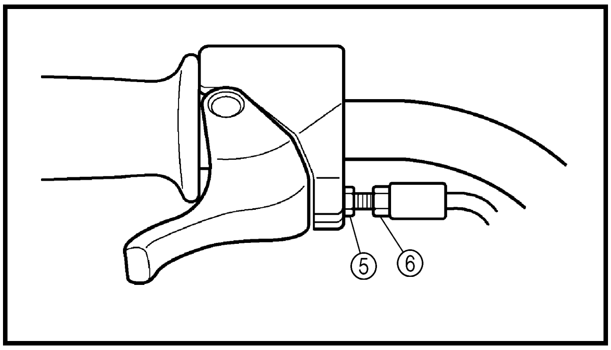
Before adjusting the throttle lever free play, adjust the trolling speed.

1. Measure:
   - Throttle lever free play ⓐ
     Out of specification → Adjust.

| | |
|---|---|
| | **Throttle lever free play:** **4–7 mm (0.16–0.28 in)** |




2. Adjust:
   - Throttle lever free play

**Adjustment steps:**

**NOTE:**
- When not replacing the throttle cable or removing the cable from the throttle body, adjust the throttle cable free play by following steps (f) through (j).
- When replacing the throttle cable or removing the cable from the throttle body, adjust the throttle cable free play by following steps (a) through (k).

a. Remove the air filter case cover ① and flame arrester.
b. Pull back the cover ②.
c. Loosen the locknut ③.
d. Turn the adjusting nut ④ to adjust the length ⓐ.

**Throttle cable installation length:**
**18.4 ± 1.0 mm (0.72 ± 0.04 in)**

**NOTE:**
Apply locking agent (LOCTITE®) to the threads of the adjusting nut ④.

e. Push in the cover ②.
f. Remove the handlebar cover.
g. Loosen the locknut ⑤.
h. Turn the adjuster ⑥ in or out until the specified free play is obtained.

| | |
|---|---|
| **Turn in** | **Free play is increased.** |
| **Turn out** | **Free play is decreased.** |

i. Tighten the locknut.

**NOTE:**
- When adjusting the throttle cable at the throttle body, fully open the throttle lever and check that the butterfly valve is fully open.
- If the throttle cable free play cannot be adjusted properly, replace the throttle cable.

j. Install the handlebar cover.

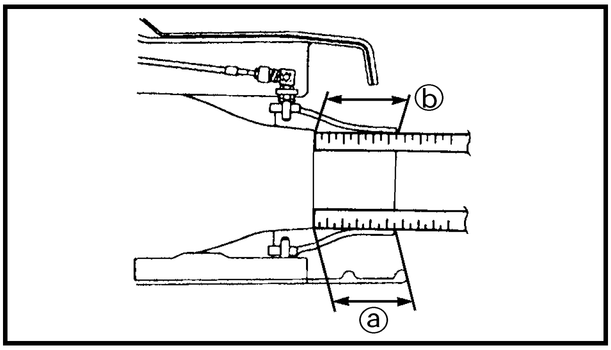
**Handlebar cover screw:**
**1.1 N • m (0.11 kgf • m, 0.8 ft • lb)**
**LOCTITE® 242**

k. Install the flame arrester and air filter case cover.

**Flame arrester bolt:**
**1st:**
**3.3 N • m**
**(0.33 kgf • m, 2.4 ft • lb)**
**2nd:**
**6.5 N • m**
**(0.65 kgf • m, 4.7 ft • lb)**
**LOCTITE® 242**
**Air filter case cover screw:**
**2.5 N • m (0.25 kgf • m, 1.8 ft • lb)**
**LOCTITE® 572**

**⚠ WARNING**

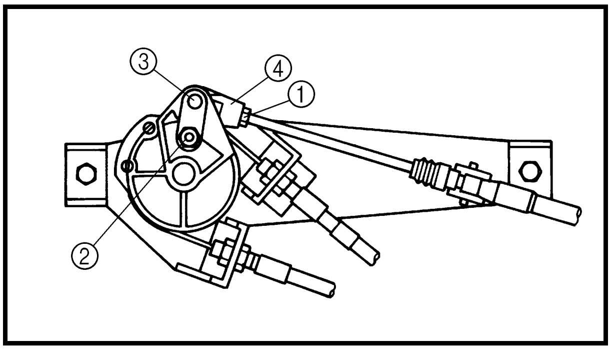
**After adjusting the free play, turn the handlebar to the right and left and make sure that the trolling speed does not increase.**

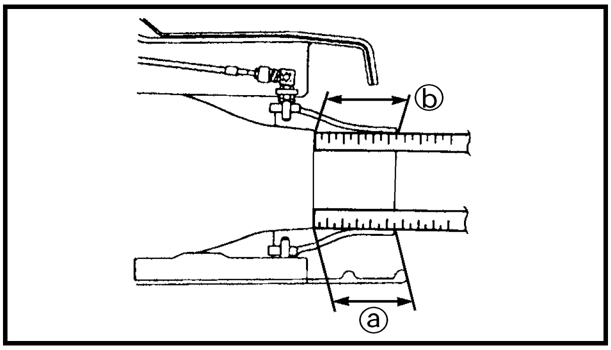



**QSTS cable inspection and adjustment**

1. Measure:
   - Jet thrust nozzle set length ⓐ, ⓑ
     Difference → Adjust.

**Measurement steps:**
- Set the control grip in the neutral position.
- Set the jet thrust nozzle in the center position.
- Measure the jet thrust nozzle set length ⓐ and ⓑ.
- If ⓐ and ⓑ length are not even, adjust the cable joint.




2. Adjust:
   • QSTS cable

**Adjustment steps:**
• Set the control grip in the neutral position.
• Loosen the locknut ①.
• Remove the nut ② and pivot pin ③.
• Set the jet thrust nozzle in the center position.
• Turn the cable joint ④ for adjusting.

| | |
|---|---|
| **Turn in** | **Length ⓐ is increased.** |
| **Turn out** | **Length ⓑ is increased.** |

**⚠ WARNING**

**The cable joint must be screwed in more than 8 mm (0.31 in).**

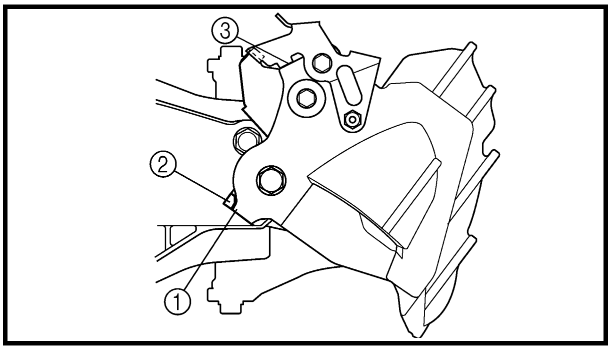
• Connect the cable joint ④ and pivot pin ③ and tighten the nut ②.

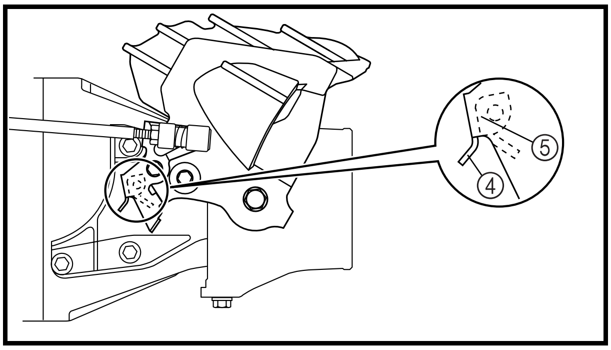
**Nut:**
**3.8 N • m (0.38 kgf • m, 2.7 ft • lb)**

• Tighten the locknut ①.

**Locknut:**
**3 N • m (0.3 kgf • m, 2.2 ft • lb)**

**NOTE:**
If the QSTS cable cannot be properly adjusted by the cable joint at the QSTS converter end, adjust the cable joint at the jet pump end so that the same lengths are obtained. Refer to “REMOTE CONTROL CABLES AND SPEED SENSOR LEAD” in Chapter 8.

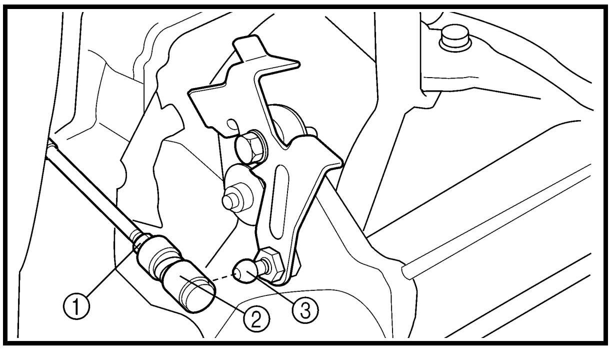


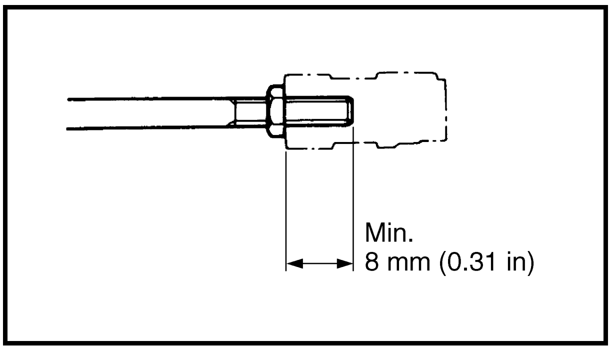



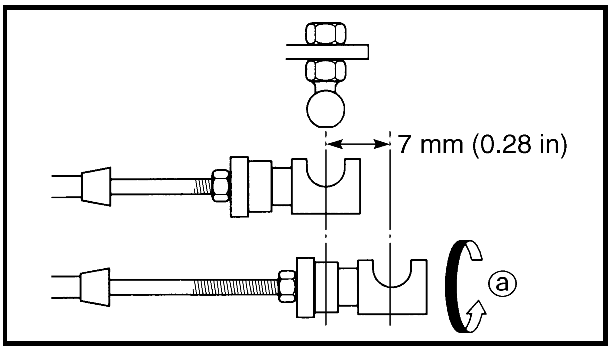

**Shift cable inspection and adjustment**

1. Check:
   - Reverse gate stopper lever position
     Incorrect → Adjust.

| **Checking steps:** |
|---|
| • Set the shift lever to the reverse position.<br>• Check that the reverse gate ① contacts the stopper ② on the bracket and the lever ③ contacts the reverse gate.<br>• Set the shift lever to the forward position.<br>• Check that the lever ④ has been shifted over the bracket ⑤. |




2. Adjust:
   - Shift cable joint

**Adjustment steps:**
- Loosen the locknut ①.
- Disconnect the cable joint ② from the ball joint ③.
- Situate the reverse gate to the stopper on the bracket and the lever to the reverse gate.
- Turn the cable joint to align it with the ball joint.

| | |
|---|---|
| **Turn in** | **Shortens.** |
| **Turn out** | **Lengthens.** |

- Turn out the cable joint nine times ⓐ to extend cable 7 mm (0.28 in) from the aligned position.

**⚠ WARNING**

**The cable joint must be screwed in more than 8 mm (0.31 in).**

- Connect the cable joint and tighten the locknut.

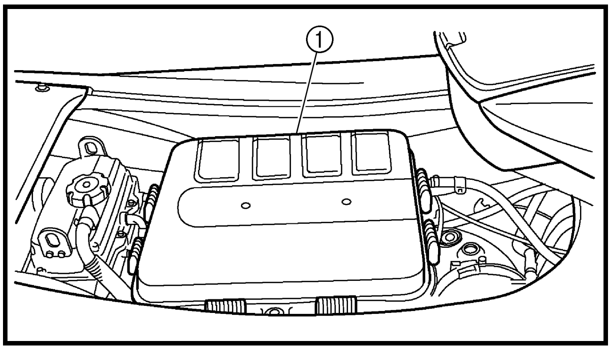
**Locknut:**
**2.9 N • m (0.29 kgf • m, 2.1 ft • lb)**

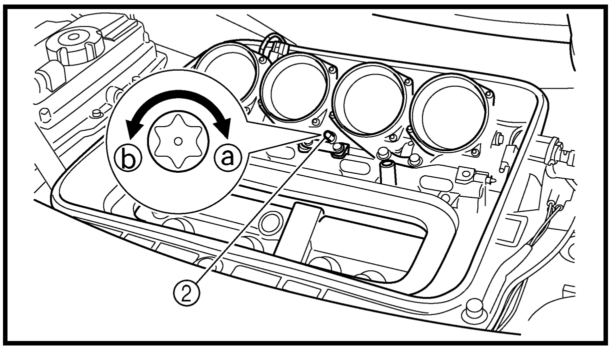
**Trolling speed check and adjustment**

1. Measure:
   - Trolling speed
     Out of specification → Adjust.

| | |
|---|---|
| | **Trolling speed:**<br>**1,600–1,800 r/min** |

**Checking steps: (Watercraft on water)**
- Start the engine and allow it to warm up for a 15 minutes.
- Check the engine trolling speed using the tachometer of the multifunction meter or using the Yamaha Diagnostic System.




2. Adjust:
   - Trolling speed

**Adjustment steps:**
- Remove the air filter case cover ①.
- Start the engine.
- Turn the throttle stop screw ② in or out until the specified speed is obtained.

| | |
|---|---|
| **Turn in ⓐ** | **Increase trolling speed.** |
| **Turn out ⓑ** | **Decrease trolling speed.** |

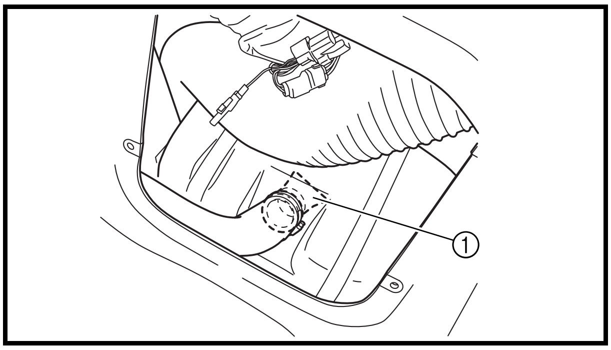
- Install the air filter case cover.

| | |
|---|---|
| | **Air filter case cover screw:**<br>**2.5 N • m (0.25 kgf • m, 1.8 ft • lb)**<br>**LOCTITE® 572** |

## FUEL SYSTEM

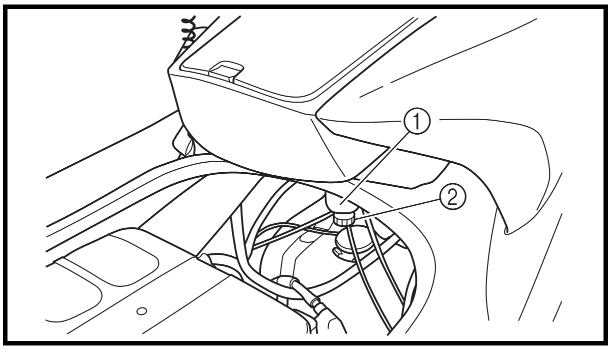
**⚠ WARNING**

**When removing fuel system parts, wrap them in a cloth and take care that no fuel spills into the engine compartment.**




**Fuel line inspection**

1. Inspect:
   - Fuel strainer ①
     Clog/contaminants → Clean.
   - Fuel pump filter
     Clog/contaminants → Clean.
     Refer to "FUEL TANK AND FUEL PUMP MODULE" in Chapter 4.
   - Fuel hose
     Damage/cracks → Replace.
   - O-rings (quick connector)
     Damage/cracks → Replace the quick connector.
   - Fuel pipe
     Damage/cracks → Replace the fuel pump.
     Refer to "FUEL INJECTION SYSTEM" in Chapter 4.
   - Fuel filler hose
   - Fuel tank
   - Fuel filler cap
     Cracks/damage → Replace.




2. Inspect:
   - Water separator ①
     Water accumulation → Drain.

**NOTE:**
If need the water draining, remove the drain plug ②.

## POWER UNIT

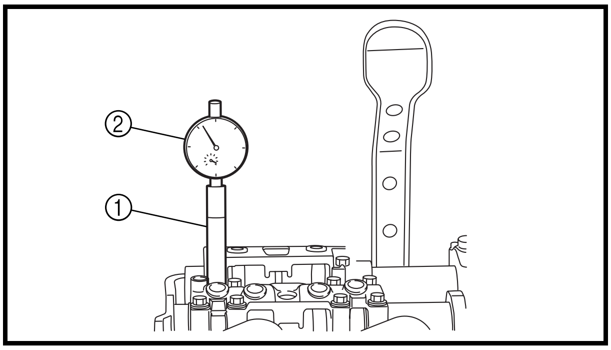
### Valve clearance adjustment

The following procedure applies to all of the valves.

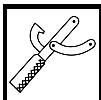
**NOTE:**

- Valve clearance adjustment should be made on a cold engine, at room temperature.
- When the valve clearance is to be measured or adjusted, the piston must be at top dead center (TDC) on the compression stroke.

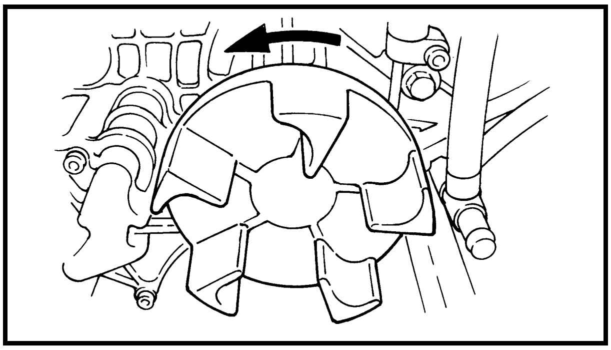
1. Remove:
   - Air filter case
     Refer to "FUEL INJECTION SYSTEM" in Chapter 4.
2. Remove:
   - Spark plugs
   - Cylinder head cover
   - Cylinder head cover gasket
     Refer to "CAMSHAFTS" in Chapter 5.

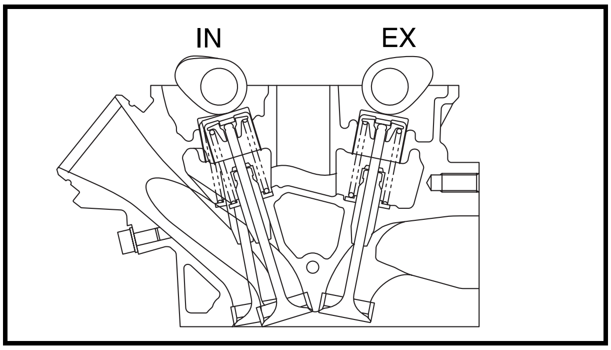


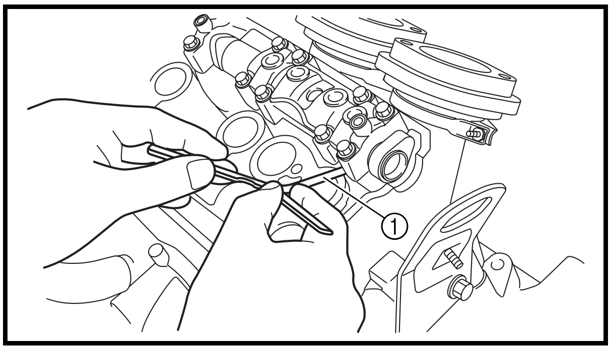

3. Install:
   - Dial gauge needle
   - Dial gauge stand ①
     (into spark plug hole #1)
   - Dial gauge ②

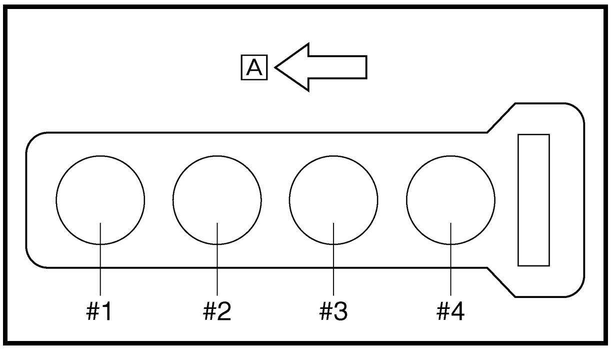


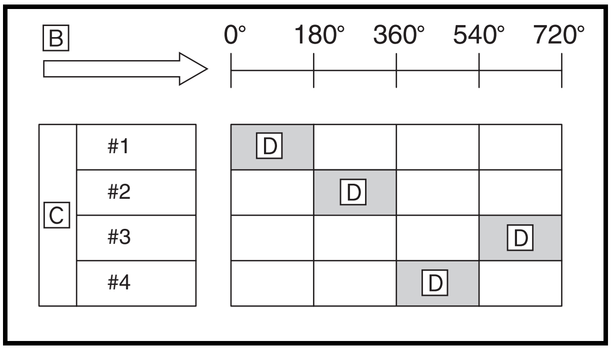
**Dial gauge stand:**
**90890-06583**
**Dial gauge needle:**
**90890-06584**
**Dial gauge stand set:**
**YW-06585/90890-06585**
**Dial gauge:**
**YU-03097/90890-01252**






4. Measure:
- Valve clearance
  Out of specification → Adjust.

**Valve clearance (cold):**
**Intake valve:**
**0.11–0.20 mm**
**(0.0043–0.0079 in)**
**Exhaust valve:**
**0.25–0.34 mm**
**(0.0098–0.0134 in)**

**Measurement steps:**
- Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.

**NOTE:**
TDC on the compression stroke can be found when the camshaft lobes are turned away from each other.

- Measure the valve clearance with a thickness gauge ①.

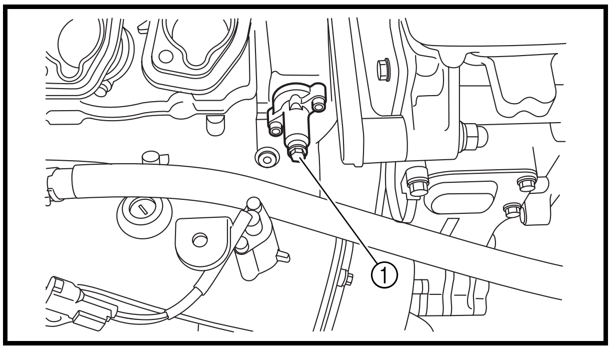
**NOTE:**
- If the valve clearance is incorrect, record the measured reading.
- Measure the valve clearance in the following sequence.

**Valve clearance measuring sequence**
**Cylinder #1 → #2 → #4 → #3**

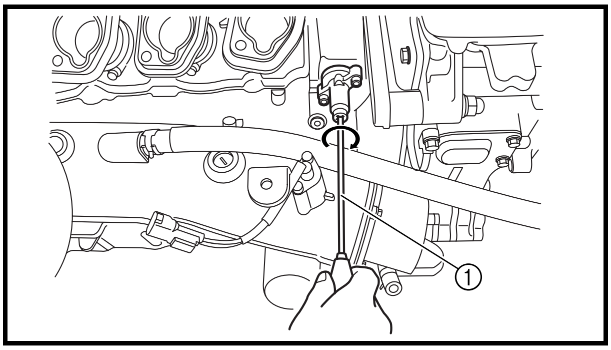
A Bow side
- To measure the valve clearances of the other cylinders, starting with cylinder #1 at TDC, turn the drive coupling counterclockwise as specified in the following table.

B Degrees that the crankshaft is turned clockwise
C Cylinder
D Combustion cycle

| | |
|---|---|
| **Cylinder #2** | **180°** |
| **Cylinder #4** | **360°** |
| **Cylinder #3** | **540°** |




5. Remove:
   - Timing chain tensioner cap bolt ①
   - Gasket

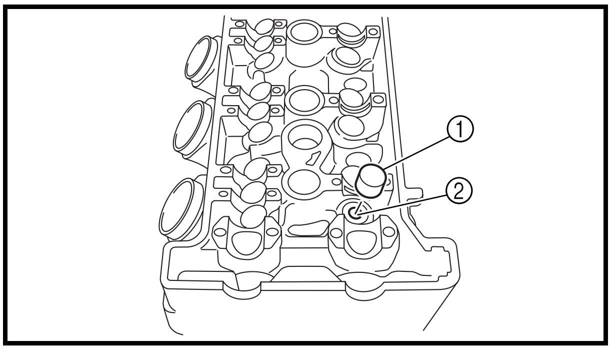


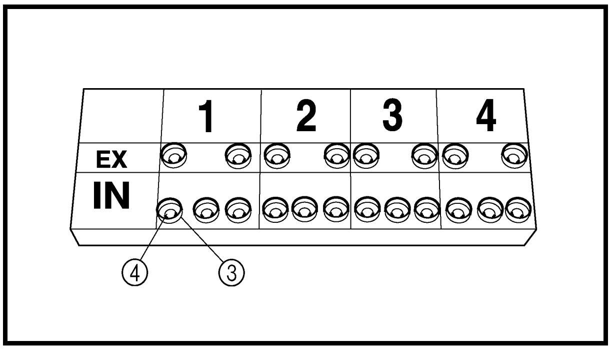

6. Turn the timing chain tensioner rod fully clockwise with a thin screwdriver ①.

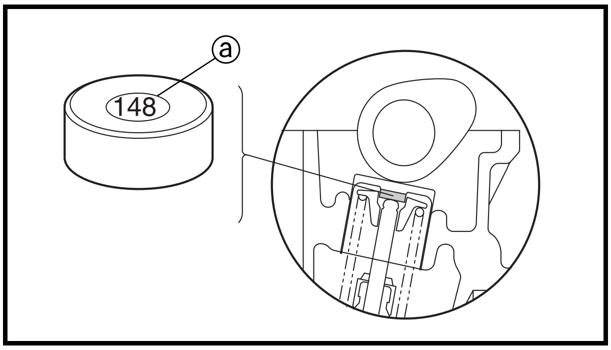
**NOTE:**
Make sure that the tensioner rod has been fully set clockwise.

7. Remove:
   - Intake camshaft caps
   - Exhaust camshaft caps
   - Timing chain
     (from the camshaft sprockets)
   - Intake camshaft
   - Exhaust camshaft

**NOTE:**
- Refer to “CAMSHAFTS” in Chapter 5.
- When removing the timing chain and camshafts, fasten the timing chain with a wire to prevent it from falling into the crankcase.




8. Adjust:
   - Valve clearance

**Adjustment steps:**

- Remove the valve lifter ① and the valve pad ②.

**NOTE:**

- Cover the timing chain opening with a rag to prevent the valve pad from falling into the crankcase.
- Make a note of the position of each valve lifter ③ and valve pad ④ so that they can be installed in the correct place.

- Select the proper valve pad from the following table.

| Valve pad thickness range | | Available valve pads |
|---|---|---|
| Nos. 120–240 | 1.20–2.40 mm | 25 thicknesses in 0.05 mm increments |

**NOTE:**

- The thickness ⓐ of each valve pad is marked in hundredths of millimeters on the side that touches the valve lifter.
- Since valve pads of various sizes are originally installed, the valve pad number must be rounded in order to reach the closest equivalent to the original.

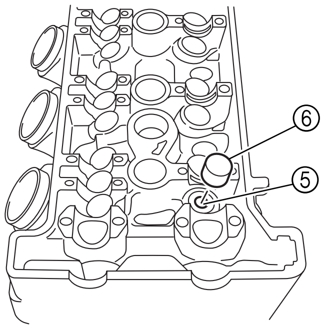
- Round off the original valve pad number according to the following table.

| Last digit | Rounded value |
|---|---|
| 0 or 2 | 0 |
| 5 | 5 |
| 8 | 10 |

**EXAMPLE:**

Original valve pad number = 148 (thickness = 1.48 mm)
Rounded value = 150

- Locate the rounded number of the original valve pad and the measured valve clearance in the valve pad selection table. The point where the column and row intersect is the new valve pad number.

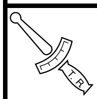



**NOTE:**
The new valve pad number is only an approximation. The valve clearance must be measured again and the above steps should be repeated if the measurement is still incorrect.

- Install the new valve pad ⑤ and the valve lifter ⑥.

**NOTE:**
- Lubricate the valve pad with molybdenum disulfide grease.
- Lubricate the valve lifter with molybdenum disulfide oil.
- The valve lifter must turn smoothly when rotated by hand.
- Install the valve lifter and the valve pad in the correct place.

- Install the exhaust and intake camshafts, timing chain and camshaft caps.



**Camshaft cap bolt:**
**10 N • m (1.0 kgf • m, 7.2 ft • lb)**

**NOTE:**
- Refer to “Camshaft installation — CAMSHAFTS” in Chapter 5.
- Lubricate the camshafts, camshaft lobes and camshaft journals.
- First, install the exhaust camshaft.
- Align the camshaft marks with the camshaft cap marks.
- Turn the crankshaft clockwise several full turns to seat the parts.

- Measure the valve clearance again.
- If the valve clearance is still out of specification, repeat all of the valve clearance adjustment steps until the specified clearance is obtained.

## Intake

| MEASURED CLEARANCE | ORIGINAL VALVE PAD NUMBER | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 |
| 0.00–0.02 | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 |
| 0.03–0.07 | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 |
| 0.08–0.10 | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 |
| 0.11–0.20 | STANDARD CLEARANCE | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.21–0.22 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | |
| 0.23–0.27 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | |
| 0.28–0.32 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | |
| 0.33–0.37 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | |
| 0.38–0.42 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | |
| 0.43–0.47 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | |
| 0.48–0.52 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | |
| 0.53–0.57 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | |
| 0.58–0.62 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | |
| 0.63–0.67 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | |
| 0.68–0.72 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | |
| 0.73–0.77 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | |
| 0.78–0.82 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | |
| 0.83–0.87 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | |
| 0.88–0.92 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | |
| 0.93–0.97 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | |
| 0.98–1.02 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | |
| 1.03–1.07 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | |
| 1.08–1.12 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | |
| 1.13–1.17 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | |
| 1.18–1.22 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | |
| 1.23–1.27 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | | |
| 1.28–1.32 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | | | |
| 1.33–1.37 | 240 | | | | | | | | | | | | | | | | | | | | | | | | |

Example:
Intake valve clearance (cold)
0.11–0.20 mm (0.0043–0.0079 in)
Rounded value 150
Measured valve clearance is 0.24 mm (0.0094 in)
Replace pad 150 with pad 160
Pad No. 150 = 1.50 mm (0.0591 in)
Pad No. 160 = 1.60 mm (0.0630 in)

## Exhaust

| MEASURED CLEARANCE | ORIGINAL VALVE PAD NUMBER | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 |
| 0.00–0.01 | | | | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 |
| 0.02–0.06 | | | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 |
| 0.07–0.11 | | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 |
| 0.12–0.16 | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 |
| 0.17–0.21 | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 |
| 0.22–0.24 | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 |
| 0.25–0.34 | STANDARD CLEARANCE | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.35–0.37 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | |
| 0.38–0.42 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | |
| 0.43–0.47 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | |
| 0.48–0.52 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | |
| 0.53–0.57 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | |
| 0.58–0.62 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | |
| 0.63–0.67 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | |
| 0.68–0.72 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | |
| 0.73–0.77 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | |
| 0.78–0.82 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | |
| 0.83–0.87 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | |
| 0.88–0.92 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | |
| 0.93–0.97 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | |
| 0.98–1.02 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | |
| 1.03–1.07 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | |
| 1.08–1.12 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | |
| 1.13–1.17 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | |
| 1.18–1.22 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | |
| 1.23–1.27 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | |
| 1.28–1.32 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | |
| 1.33–1.37 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | |
| 1.38–1.42 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | | |
| 1.43–1.47 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | | | |
| 1.48–1.52 | 240 | | | | | | | | | | | | | | | | | | | | | | | | |

Example:
Exhaust valve clearance (cold)
0.25–0.34 mm (0.0098–0.0134 in)
Rounded value 170
Measured valve clearance is 0.44 mm (0.0173 in)
Replace pad 170 with pad 185
Pad No. 170 = 1.70 mm (0.0669 in)
Pad No. 185 = 1.85 mm (0.0728 in)

9. Remove:
   - Dial gauge
   - Dial gauge stand
   - Dial gauge needle
10. Install:
    - All removed parts

**NOTE:**
For installation, reverse the removal procedure.

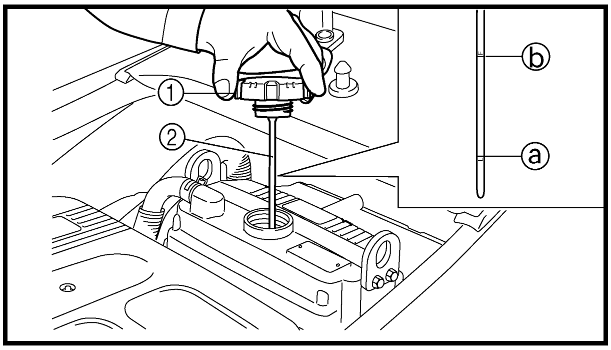
**Engine oil level check**

1. Place the watercraft in a horizontal position.
2. Check:
   - Engine oil level

**Checking steps:**

**CAUTION:**

- **When checking the oil level in water, stay clear of other boats. The watercraft could be drifted away by the current or wind.**
- **Do not run the engine for more than 15 seconds without supplying water, when checking the oil level on land. The engine could overheat.**
- **Do not run the engine with too much or not enough oil in the oil tank. Oil could spray out or the engine could be damaged.**




- Remove the oil filler cap ① and check for oil on the dipstick ②.
- If there is no oil on the dipstick, pour enough oil so that the tip of the dipstick comes into contact with the oil, and then install the filler cap.
- **In water**
  a. Place the watercraft in water, and then start the engine.
  b. Run the engine at 7,000 r/min or more for more than 5 minutes.
  c. Run the engine at trolling speed for 2–3 minutes.
  d. Stop the engine.
- **On land**
  a. Connect the flushing hose connector to the watercraft.
  b. Start the engine, and then turn on the water supply.
  c. Run the engine at trolling speed for 6–8 minutes.
  d. Turn the water supply off, and then stop the engine.

**CAUTION:**

**When checking the oil level on land, be sure to connect a garden hose to the watercraft for proper water supply.**

**NOTE:**

If the ambient temperature is less than 15 °C (59 °F), run the engine for an additional 5 minutes.

- Remove the oil filler cap ①, wipe the dipstick ② clean, insert it back into the filler hole, and then remove it again to check the oil level.

**NOTE:**

The engine oil should be between the minimum level mark ⓐ and maximum level mark ⓑ.

- If the engine oil is below the minimum level mark ⓐ, add sufficient oil of the recommended type to raise it to the correct level.
- If the engine oil is above the maximum level mark ⓑ, extract sufficient oil using an oil changer to lower it to the correct level.

**NOTE:**
If the oil temperature is low, the reading on the dipstick will be low, and if the temperature is high, the reading on the dipstick will be high.

**Engine oil change — using oil changer**

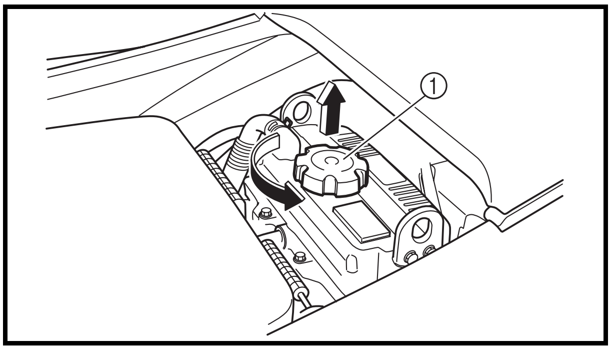
**WARNING**

**Avoid changing the engine oil immediately after turning the engine off. The oil is hot and should be handled with care to avoid burns.**

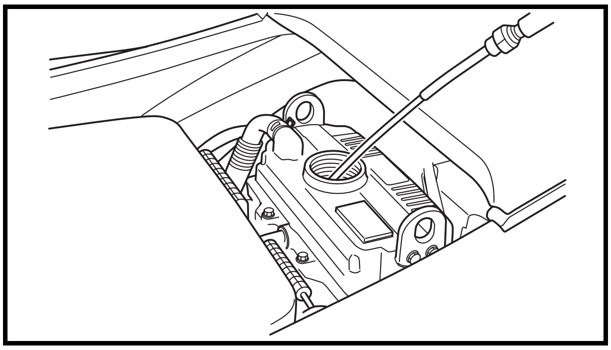
**CAUTION:**

- **Do not run the engine with too much or not enough oil in the oil tank. Oil could spray out or the engine could be damaged.**
- **Do not run the engine for more than 15 seconds without supplying water, when checking the oil level on land.**
  **The engine could overheat.**
- **Be sure to change the engine oil after the first 10 hours of operation, and every 100 hours thereafter or at the start of a new season, otherwise the engine will wear quickly.**

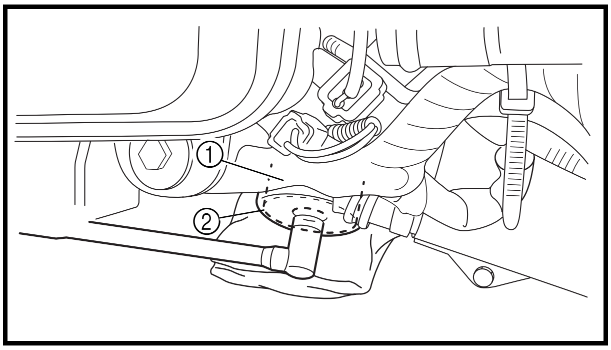
1. Warm the engine up, and then put the watercraft in a horizontal position.

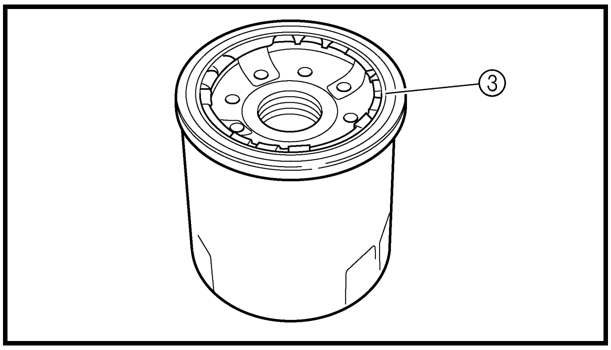



2. Remove:
   - Oil filler cap ①



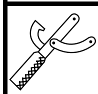
3. Insert the tube of an oil changer into the oil filler hole.
4. Operate the oil changer to extract the oil.




5. If the oil filter is also to be replaced, perform the following procedure.

**Replacing steps:**
- Place a rag under the oil filter.
- Remove the oil filter ① with an oil filter wrench ②.

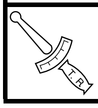
| | |
|---|---|
|  | **Oil filter wrench:**<br>**YU-38411/90890-01426** |

- Lubricate the O-ring ③ of the new oil filter with a thin coat of engine oil.

**CAUTION:**

**Make sure the O-ring ③ is positioned correctly in the groove of the oil filter.**

- Tighten the new oil filter to specification with an oil filter wrench.

| | |
|---|---|
|  | **Oil filter:**<br>**17 N • m (1.7 kgf • m, 12 ft • lb)** |

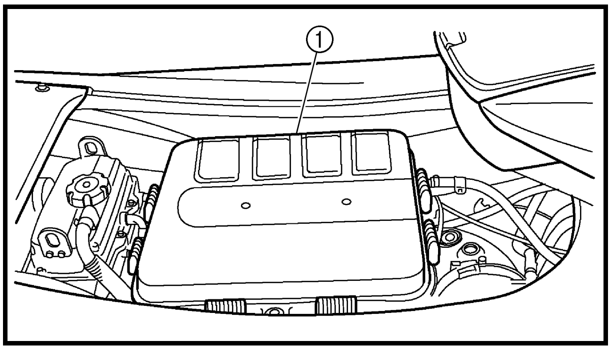
6. Pour the specified amount of the recommended engine oil into the oil filler hole.
7. Fill:
   - Oil tank
     (with the specified amount of the recommended engine oil)

**Recommended oil:**
**SAE 10W-30**
**API SE, SF, SG, SH, SJ**
**Oil quantity:**
**Total amount:**
**4.3 L (4.5 US qt, 3.8 Imp qt)**
**With oil filter replacement:**
**2.2 L (2.3 US qt, 1.9 Imp qt)**
**Without oil filter replacement:**
**2.0 L (2.1 US qt, 1.8 Imp qt)**

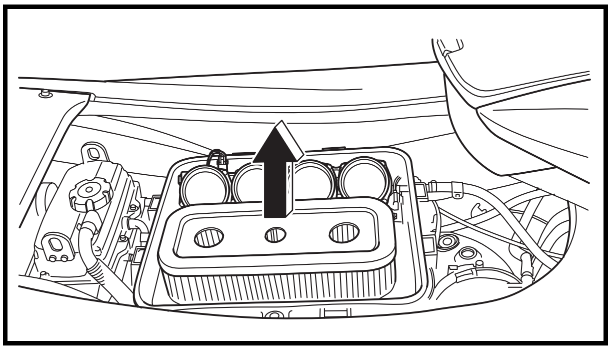
**CAUTION:**

**When starting the engine make sure the dipstick is securely fitted into the oil tank.**

8. Install:
   - Oil filler cap




**Air filter element clean**
1. Remove:
   - Air filter case cover ①



2. Remove the air filter element and check it for dirt and oil. Replace the air filter element if there is any oil buildup.

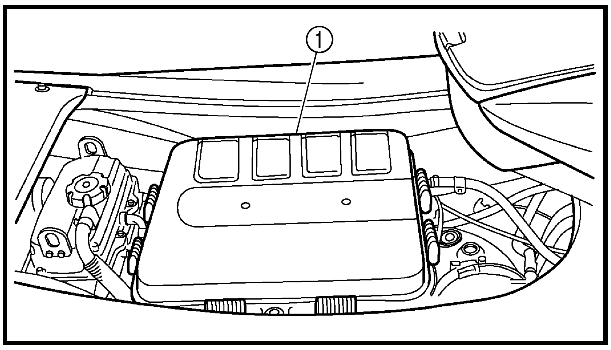
**CAUTION:**

- **Make sure that the air filter element is installed in the filter case properly.**
- **Do not start the engine with the air filter element removed, otherwise the engine could be damaged.**
- **If cleaning the air filter element, use cold or lukewarm water and let it air dry completely. Do not use detergent or an solvent to clean the air filter element, or dry it with heat or compressed air, otherwise it could be damaged.**

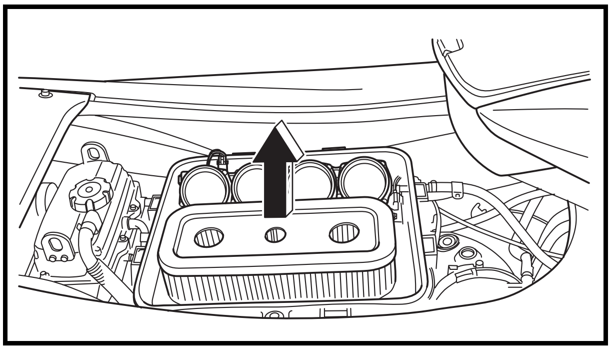
3. Install:
   - Air filter case cover

**Air filter case cover screw:**
**2.5 N • m (0.25 kgf • m, 1.8 ft • lb)**
**LOCTITE® 572**

**Spark plug inspection**



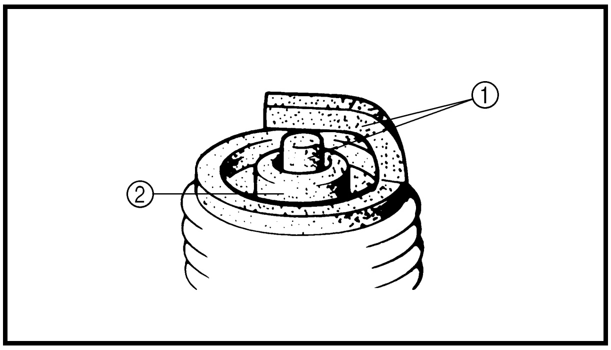

1. Remove:
   - Air filter case cover ①



2. Remove:
   - Air filter element

**CAUTION:**

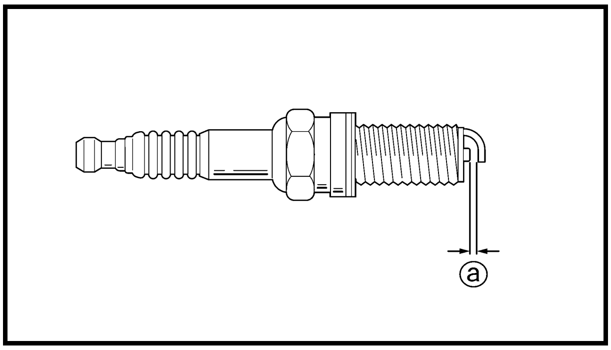
**Be careful not to get any foreign substances or water in the air intake port and spark plug hole.**




3. Inspect:
   - Electrodes ①
     Damage/wear → Replace.
   - Insulator color ②
     Distinctly different color → Check the engine condition.

| | |
|---|---|
| | **Color guide:**<br>**Medium to light tan color:**<br>**Normal**<br>**Whitish color:**<br>**Lean fuel mixture**<br>**Air leak**<br>**Incorrect settings**<br>**Blackish color:**<br>**Overly rich mixture**<br>**Electrical malfunction**<br>**Defective spark plug** |

4. Clean:
   - Spark plug
     (with a spark plug cleaner or wire brush)



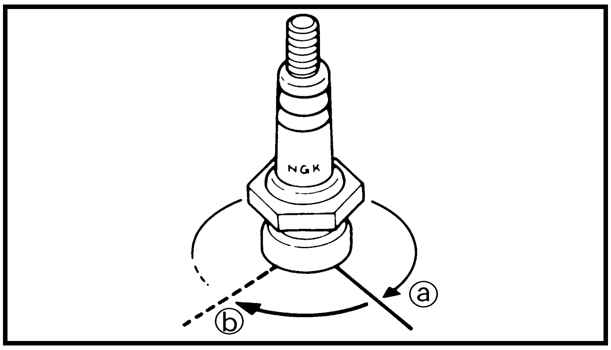

5. Measure:
   - Spark plug gap ⓐ
     Out of specification → Regap.

| | |
|---|---|
| | **Spark plug gap:**<br>**0.7–0.8 mm (0.028–0.031 in)** |

6. Tighten:
   - Spark plug

| | |
|---|---|
| | **Spark plug:**<br>**13 N • m (1.3 kgf • m, 9.4 ft • lb)** |

**NOTE:**
- Before installing the spark plug, clean the gasket surface and spark plug surface. Also, it is suggested to apply a thin film of anti-seize compound to the spark plug threads to prevent thread seizure.
- If a torque wrench is not available, a good estimate of the correct tightening torque for a new spark plug is to finger tighten ⓐ the spark plug and then tighten it another 1/4 to 1/2 of a turn ⓑ.



7. Install:
   - Air filter element
   - Air filter case cover

| | |
|---|---|
| | **Air filter case cover screw:**<br>**2.5 N • m (0.25 kgf • m, 1.8 ft • lb)**<br>**LOCTITE® 572** |

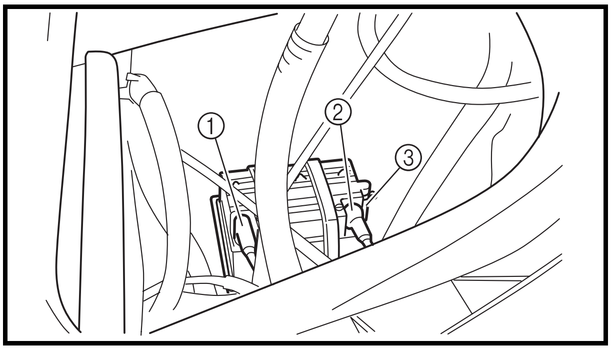
## ELECTRICAL
### Battery inspection

**⚠ WARNING**

**Battery electrolyte is poisonous and dangerous, causing severe burns, etc. Electrolyte contains sulfuric acid. Avoid contact with skin, eyes or clothing.**
**Antidotes**
**External: Flush with water.**
**Internal: Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Call physician immediately.**
**Eyes: Flush with water for 15 minutes and get prompt medical attention.**
**Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc., well away. If using or charging the battery in an enclosed space, make sure that it is well ventilated. Always shield your eyes when working near batteries.**
**KEEP OUT OF THE REACH OF CHILDREN.**

**CAUTION:**

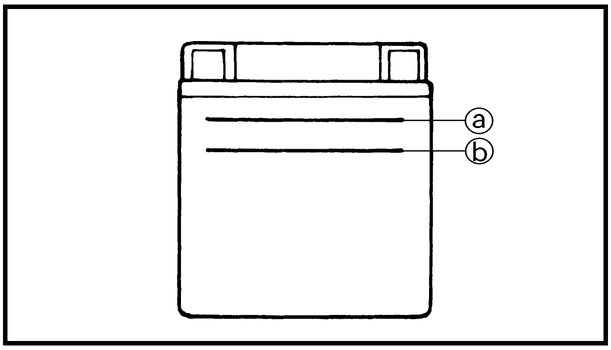
**Be careful not to place the battery on its side.**
**Make sure to remove the battery from the battery compartment when adding battery electrolyte or charging the battery.**
**When checking the battery, make sure the breather hose is connected to the battery and not obstructed.**




1. Remove:
   - Bands
   - Battery negative lead ①
   - Battery positive lead ②
   - Battery
   - Battery breather hose ③

**⚠ WARNING**

- **When removing the battery, disconnect the negative lead first.**
- **Remove the battery to prevent acid loss during turning the machine on its side for the impeller service.**




2. Inspect:
   - Electrolyte level
     Low → Add distilled water.
     The electrolyte level should be between the upper ⓐ and lower ⓑ level marks.

**Filling steps:**
- Remove each filler cap.
- Add distilled water.
- When the electrolyte level reaches the upper level mark, allow the cell to stand for 20 minutes. If the electrolyte level drops, add more distilled water so the level reaches the upper level mark.

**CAUTION:**

**Use only distilled water. Other types of water contain minerals which are harmful to batteries.**

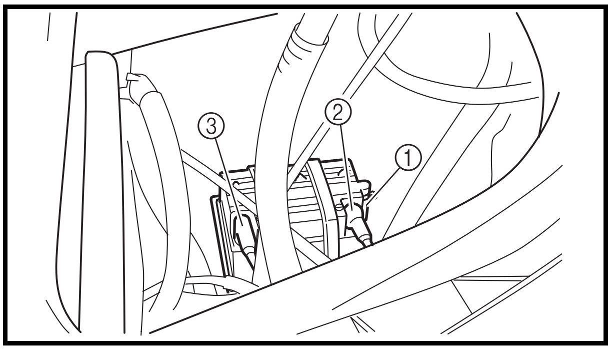
3. Inspect:
   - Specific gravity
     Out of specification → Charge.

**Specific gravity at 20 °C (68 °F):**
**1.28**
**Charging current:**
**1.9 amps × 10 hrs**

4. Install:
   - Filler caps

**CAUTION:**

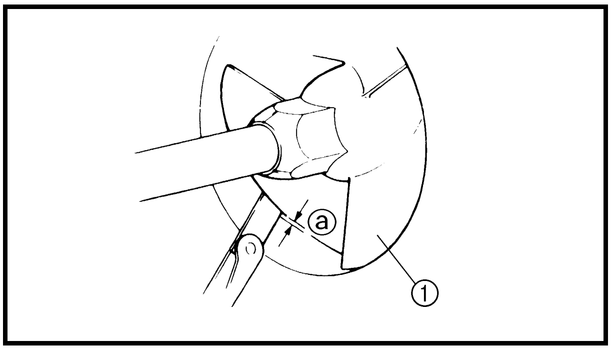
**Before installation, rinse off any fluid from the battery box and battery and make sure that the battery is dry before installing it.**




5. Install:
   - Battery breather hose ①
   - Battery
   - Battery positive lead ②
   - Battery negative lead ③
   - Bands

**CAUTION:**

- **Connect the positive lead to the battery terminal first.**
- **Make sure the battery leads are connected properly. Reversing the leads can seriously damage the electrical system.**
- **Make sure that the battery breather hose is properly connected and is not obstructed.**
- **Coat the terminals with a water resistant grease to minimize terminal corrosion.**



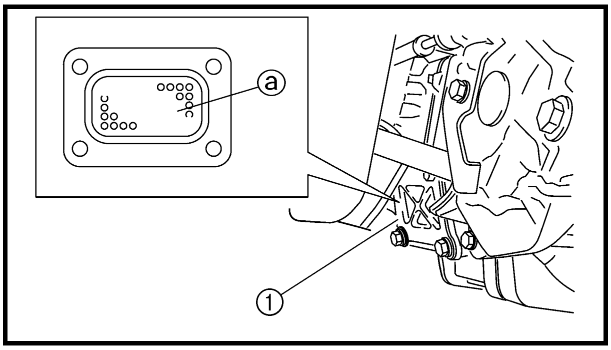

## JET PUMP UNIT

### Impeller inspection

1. Check:
   - Impeller ①
     Damage/wear → Replace.
     Nicks/scratches → File or grind.
2. Measure:
   - Impeller-to-housing clearance ⓐ
     Out of specification → Replace.

**Max. impeller-to-housing clearance:**
**0.6 mm (0.0236 in)**

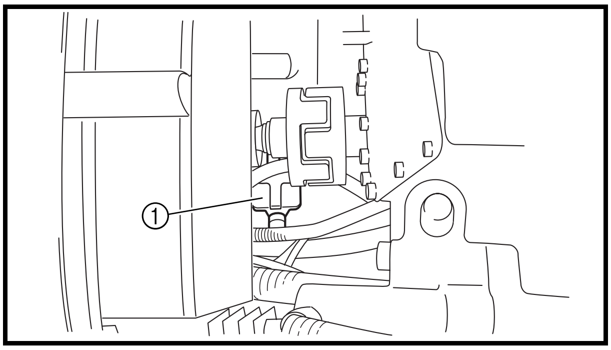
**Measurement steps:**
- Remove the battery leads.
- Remove the intake grate and intake duct. Refer to “INTAKE GRATE, RIDE PLATE, AND INTAKE DUCT” in Chapter 6.
- Measure the clearance at each impeller blade as shown (a total of three measurements).
- Install the intake duct and intake grate. Refer to “INTAKE GRATE, RIDE PLATE, AND INTAKE DUCT” in Chapter 6.
- Install the battery leads.

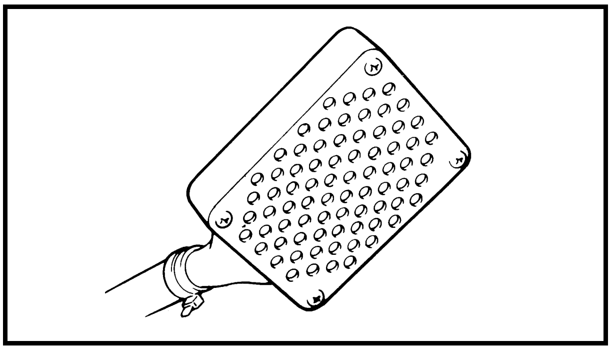



**Water inlet strainer inspection**

1. Inspect:
   - Water inlet strainer
     Contaminants → Clean.
     Cracks/damage → Replace.

**Inspection steps:**
- Remove the ride plate.
  Refer to "INTAKE GRATE, RIDE PLATE, AND INTAKE DUCT" in Chapter 6.
- Remove the rubber plate.
  Refer to "JET PUMP UNIT" in Chapter 6.
- Remove the water inlet cover ①.
- Inspect the water inlet strainer mesh ⓐ.
- Install the water inlet cover.
- Install the rubber plate.
  Refer to "JET PUMP UNIT" in Chapter 6.
- Install the ride plate.
  Refer to "INTAKE GRATE, RIDE PLATE, AND INTAKE DUCT" in Chapter 6.



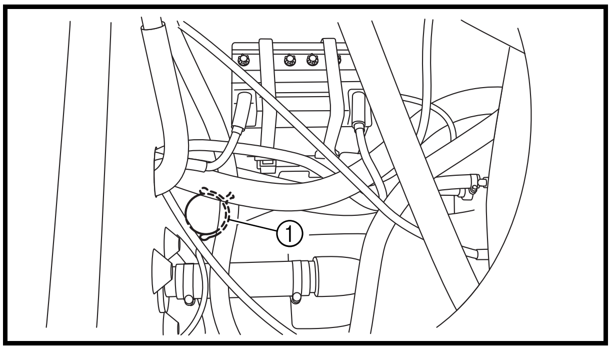



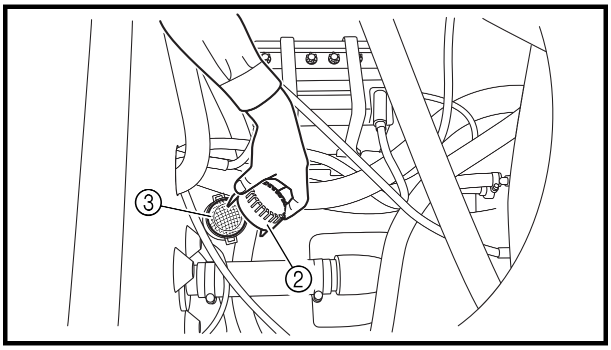
## BILGE PUMP

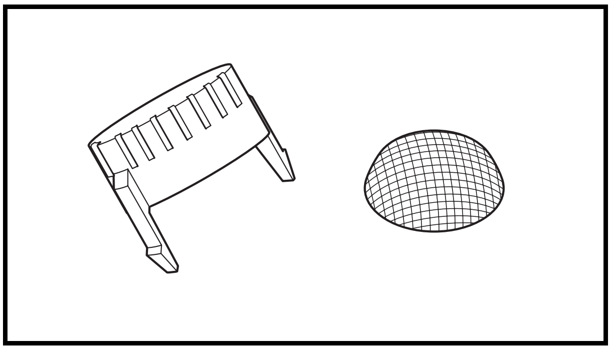
**Bilge strainer inspection**

1. Inspect:
   - Bilge strainer
     Contaminants → Clean.
     Cracks/damage → Replace.

**Inspection steps:**
- Remove the deck beam.
  Refer to "SEATS AND HAND GRIP" in Chapter 8.
- Remove the coupling cover.
- Disconnect the bilge strainer ① from the bilge strainer holder.
- Inspect the bilge strainer.
- Install the coupling cover.
- Install the deck beam.
  Refer to "SEATS AND HAND GRIP" in Chapter 8.



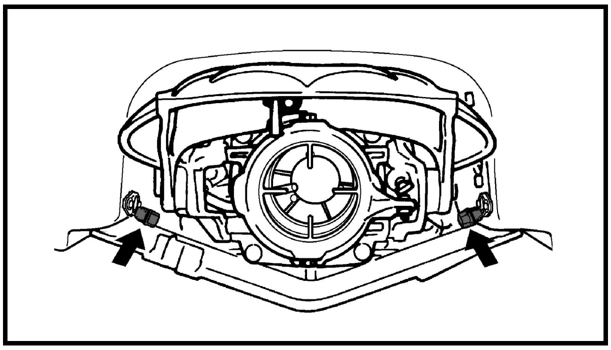



**Electric bilge pump strainer inspection**

1. Inspect:
   - Cap
   - Strainer
     Contaminants → Clean.

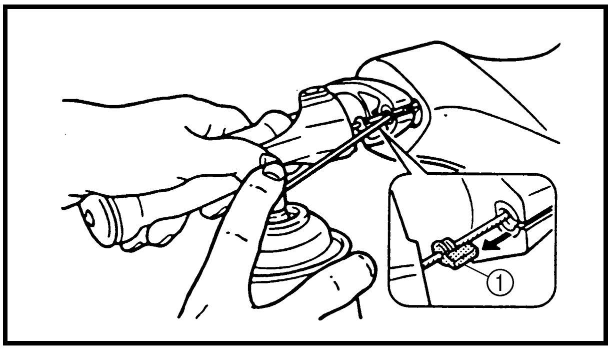
**Inspection steps:**
- Remove the band ①.
- Remove the cap ② and strainer ③.
- Inspect the cap and strainer.
- Install the strainer and cap.
- Install the band.

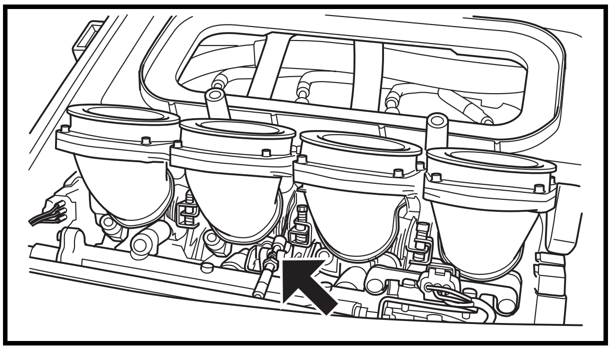


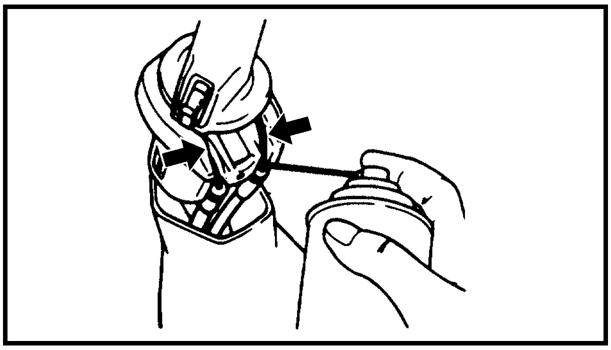
## GENERAL

**Drain plug inspection**

1. Inspect:
   - Drain plugs
     Cracks/damage → Replace.
   - O-rings
     Cracks/wear → Replace.
   - Screw threads
     Contaminants → Clean.





**Lubrication points**

1. Lubricate:
   - Throttle cable (handlebar end)

| Recommended lubricant: Rust inhibitor |
|---|

**NOTE:**

Before lubricating the throttle cable, squeeze the throttle lever and remove the rubber seal ①.

2. Lubricate:
   - Throttle cable (throttle body end)

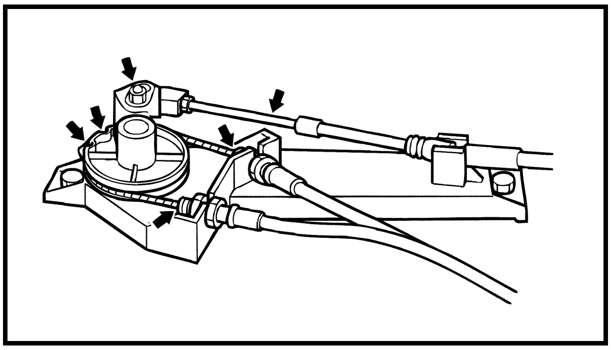
| Recommended lubricant: Yamaha marine grease, Yamaha grease A (Water resistant grease) |
|---|

3. Lubricate:
   - QSTS control cables (handlebar end)

| Recommended lubricant: Yamaha marine grease, Yamaha grease A (Water resistant grease) |
|---|

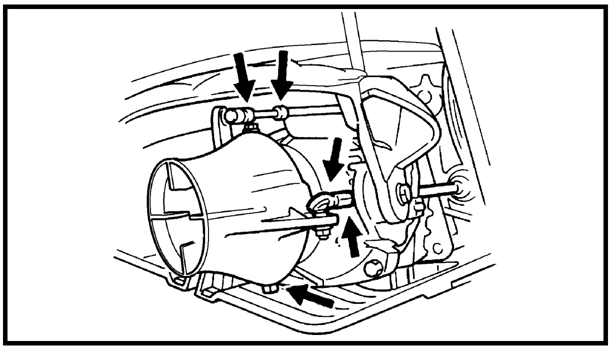
**NOTE:**

Before lubricating the QSTS control cables, remove the QSTS cable housing cover. Spray the rust inhibitor into the outer cables, and apply grease to the inner cables.



4. Lubricate:
   - QSTS cables (pulley end)

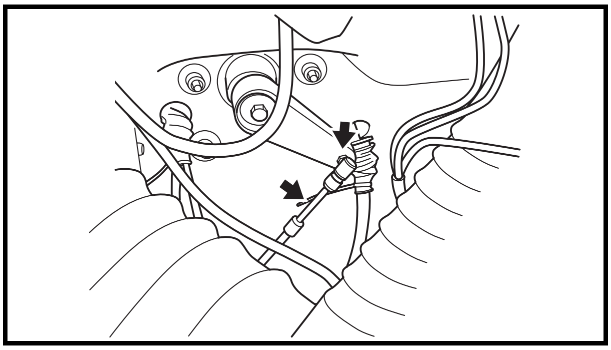
| Recommended grease: Yamaha marine grease, Yamaha grease A (Water resistant grease) |
|---|

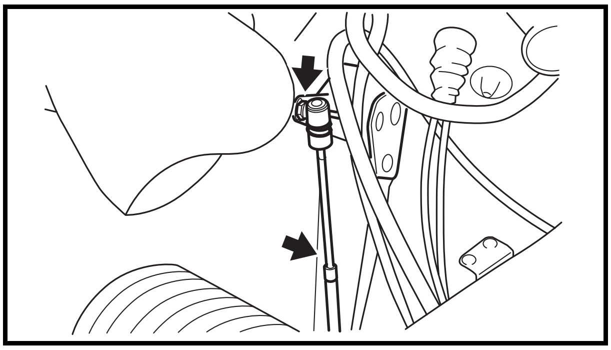


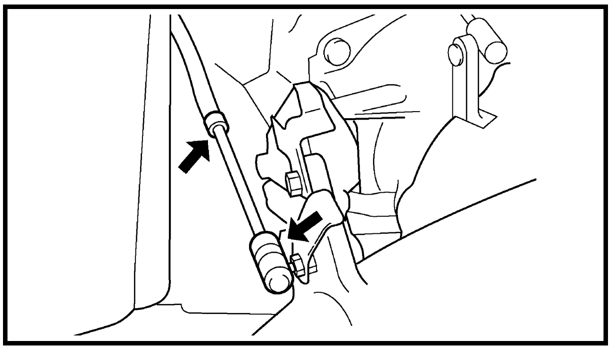
5. Lubricate:
   - Nozzle pivot shaft
   - Steering cable (nozzle end)
   - QSTS cable (nozzle end)



**Recommended grease:**
**Yamaha marine grease,**
**Yamaha grease A**
**(Water resistant grease)**





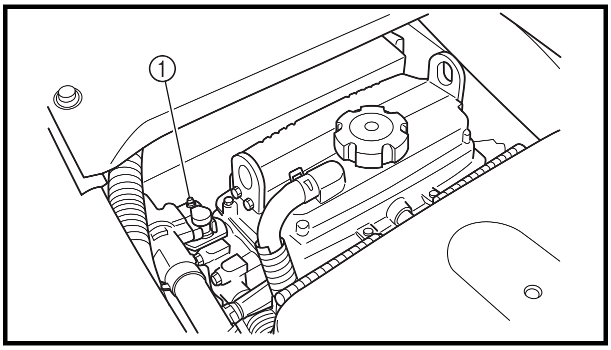


6. Lubricate:
   - Steering cable
   - Steering cable joint
   - Shift cable
   - Shift cable joint

**NOTE:**
Disconnect the joints and apply a small amount of grease.



**Recommended grease:**
**Yamaha marine grease,**
**Yamaha grease A**
**(Water resistant grease)**




7. Fill:
   - Intermediate housing

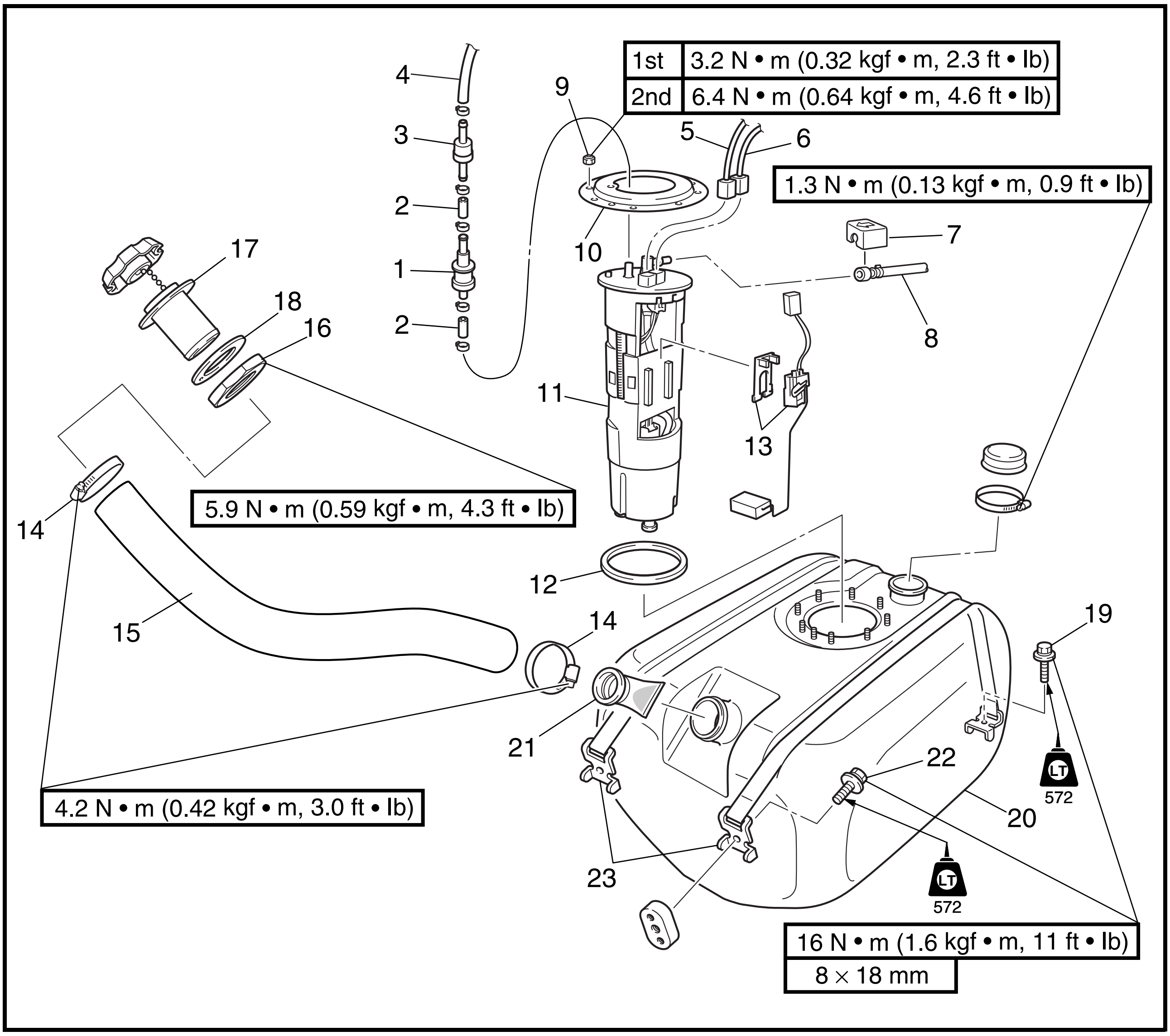


**Recommended grease:**
**Yamaha marine grease,**
**Yamaha grease A**
**(Water resistant grease)**
**Grease quantity:**
**Initial 10 hours:**
**33.0–35.0 cm$^3$ (1.11–1.18 oz)**
**Every 100 hours or 12 months:**
**6.0–8.0 cm$^3$ (0.20–0.27 oz)**

**NOTE:**
Fill the intermediate housing with the recommended grease through the grease nipple ①.

# CHAPTER 4
# FUEL SYSTEM

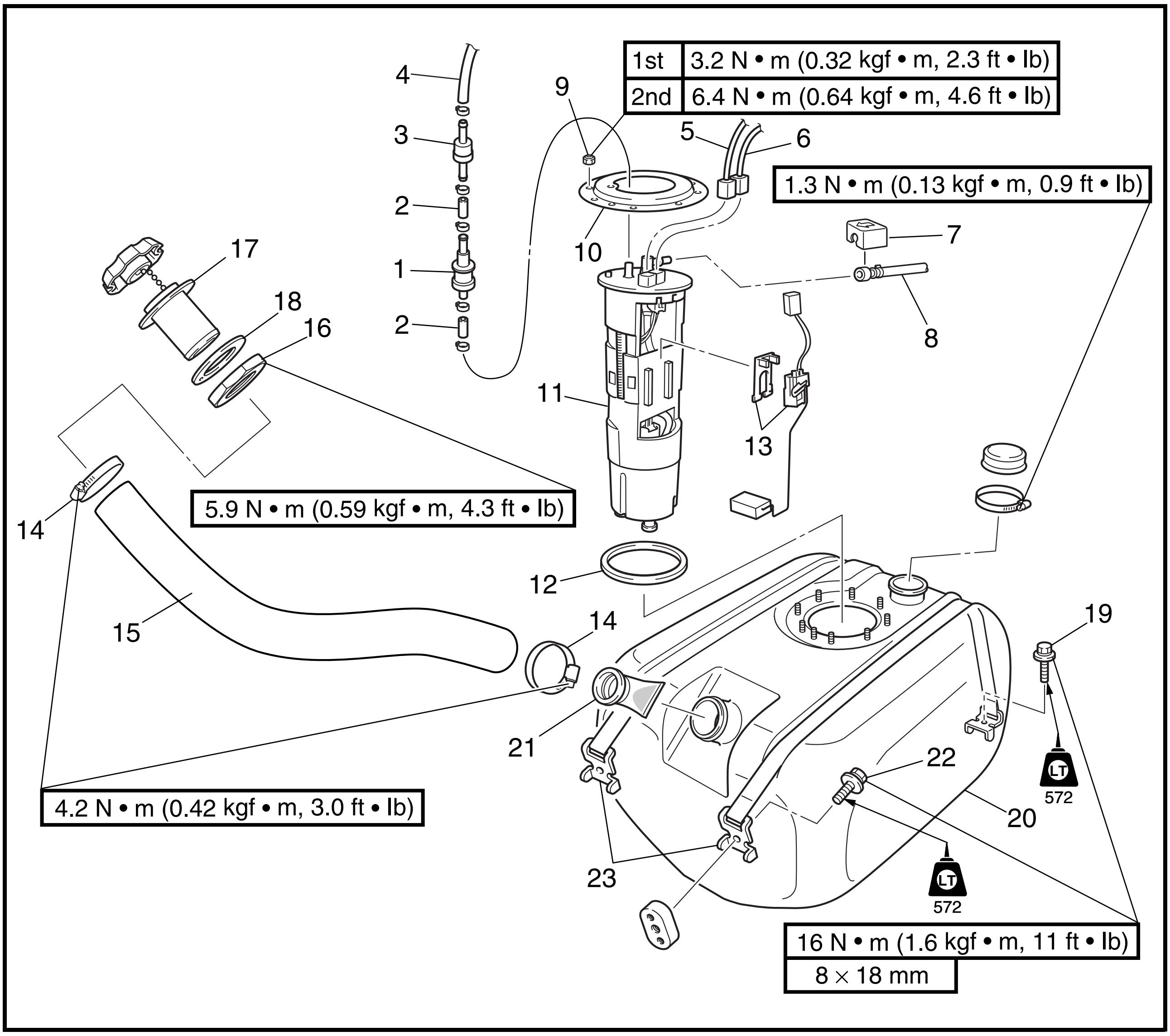
# FUEL TANK AND FUEL PUMP MODULE
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

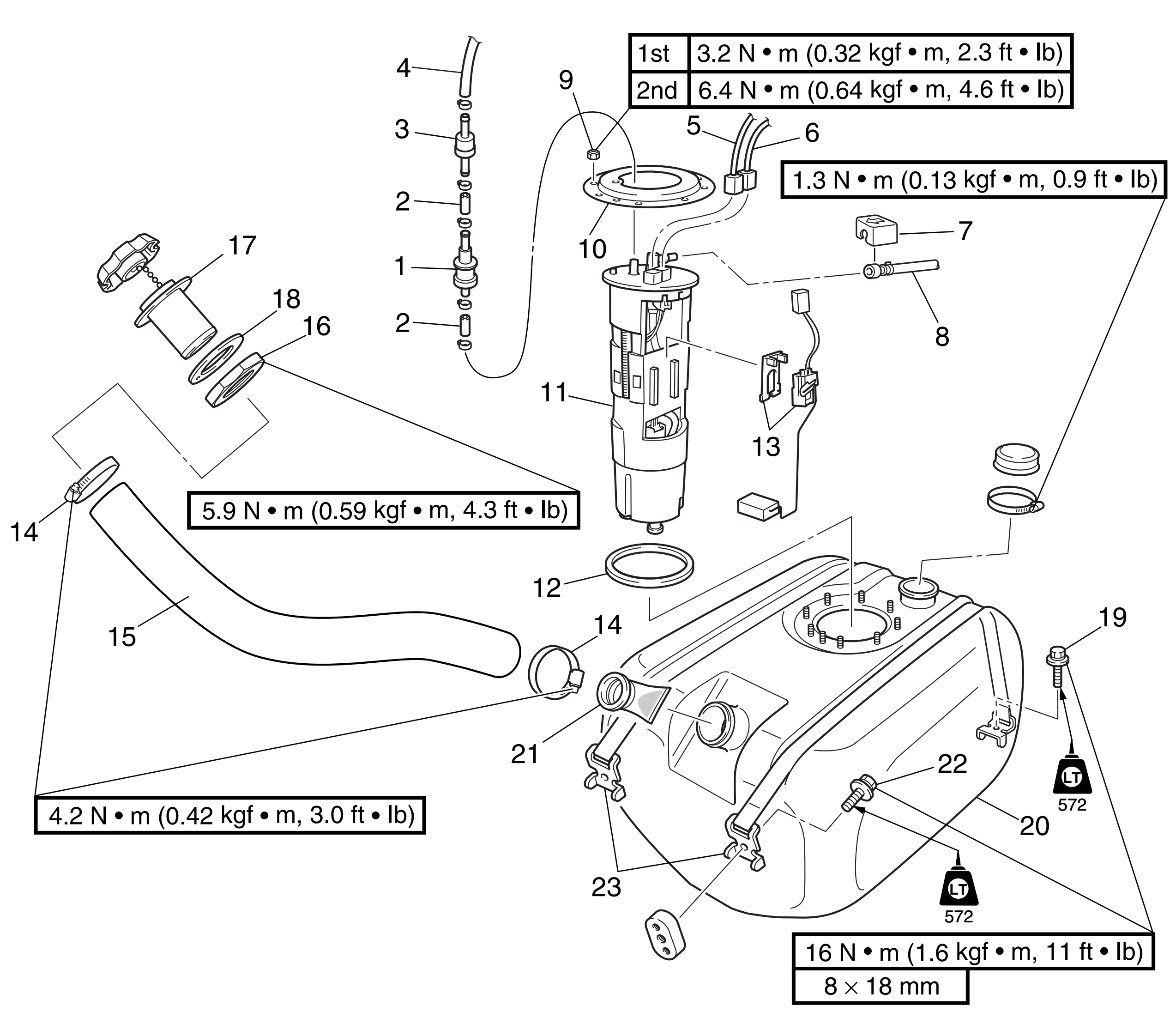
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FUEL TANK REMOVAL** | | Follow the left "Step" for removal. |
| | Service lid 1 | | Refer to "FRONT HOOD" in Chapter 8. |
| | Service lid 2 | | |
| | Ventilation hose | | From ventilation fitting |
| | Engine unit | | Refer to "ENGINE UNIT" in Chapter 5. **NOTE:** When removing the pump module only, it is not necessary to remove the engine unit. |
| 1 | Rollover valve | 1 | |
| 2 | Fuel tank breather hose | 2 | |
| 3 | Check valve | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 4 | Fuel tank breather hose | 1 | **NOTE:** |
| 5 | Fuel sender coupler | 1 | Make sure that the inner seal of the coupler is installed properly before connecting the coupler. |
| 6 | Fuel pump module coupler | 1 | |
| 7 | Cover | 1 | |
| 8 | Fuel hose | 1 | |
| 9 | Nut | 9 | |
| 10 | Retainer | 1 | |
| 11 | Fuel pump module | 1 | |
| 12 | Packing | 1 | |

## EXPLODED DIAGRAM

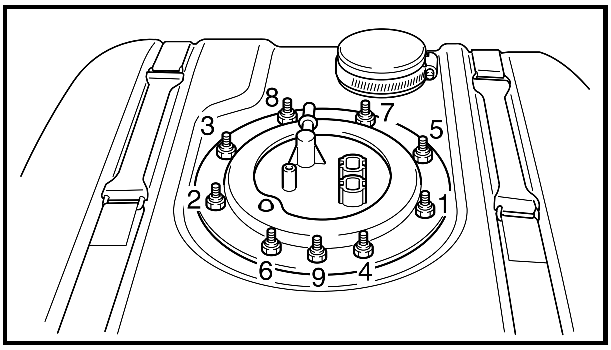



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 13 | Fuel sender assembly | 1 | |
| 14 | Hose clamp | 2 | |
| 15 | Fuel filler hose | 1 | |
| 16 | Nut | 1 | |
| 17 | Fuel filler neck | 1 | |
| 18 | Rubber seal | 1 | |
| 19 | Bolt | 2 | |
| 20 | Fuel tank assembly | 1 | |
| 21 | Strainer | 1 | |
| 22 | Bolt | 2 | |
| 23 | Fuel tank belt | 2 | |
| | | | Reverse the removal steps for installation. |

## SERVICE POINTS

### Fuel hose disconnection

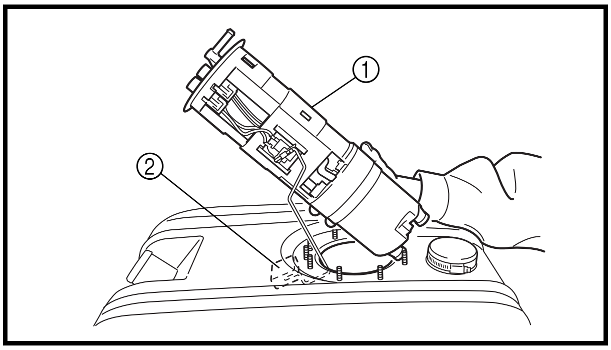
1. Disconnect:
   - Fuel hose
     Refer to "FUEL INJECTION SYSTEM".




### Fuel pump module removal

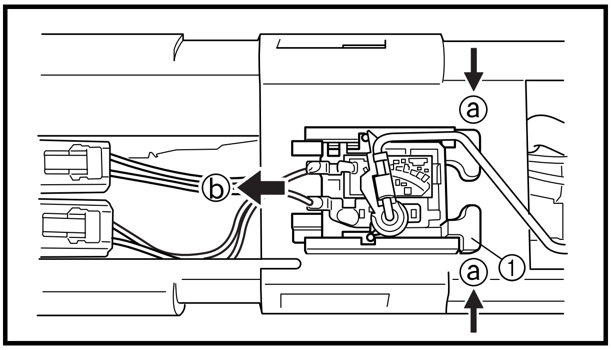
1. Remove:
   - Nuts
   - Retainer

**NOTE:**
Loosen the nuts in the sequence shown.




2. Remove:
   - Fuel pump module ①

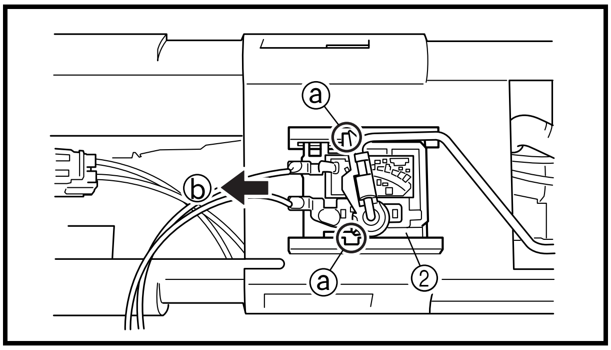
**NOTE:**
Remove the float ② at an angle because it could catch on the fuel tank.




### Fuel sender disassembly

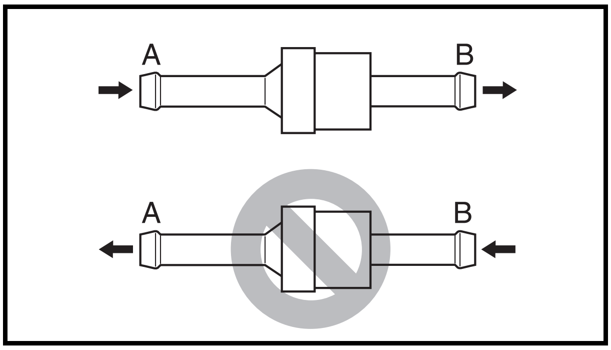
1. Disconnect:
   - Fuel sender coupler
2. Remove:
   - Retainer ①

**NOTE:**
Push the tabs in direction of arrows ⓐ and slide the retainer ① in direction of arrow ⓑ.




3. Remove:
   - Fuel sender

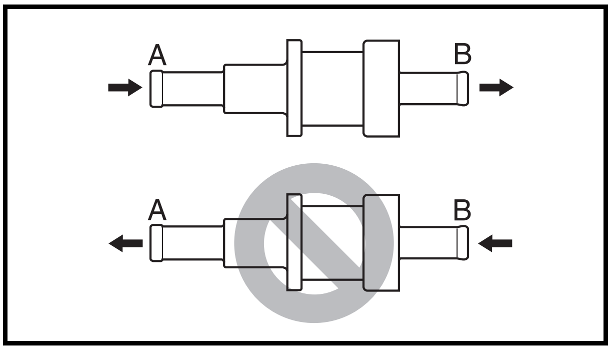
**NOTE:**
Push the tabs ⓐ and remove the fuel level sender ② in the direction of the arrow ⓑ.




**Check valve inspection**

1. Check:
   - Check valve
     Faulty → Replace.

**Checking steps:**
- Connect a hose to the end of check valve "A" and blow into it.
  Air should come out from end "B".
- Connect the hose to the end of check valve "B" and blow into it.
  Air should not come out from end "A".




**Rollover valve inspection**

1. Check:
   - Rollover valve
     Faulty → Replace.

**Checking steps:**
- Connect a hose to the end of rollover valve "A" and blow into it.
  Air should come out from end "B".
- Connect the hose to the end of rollover valve "B" and blow into it.
  Air should not come out from end "A".

**Fuel level sender inspection**

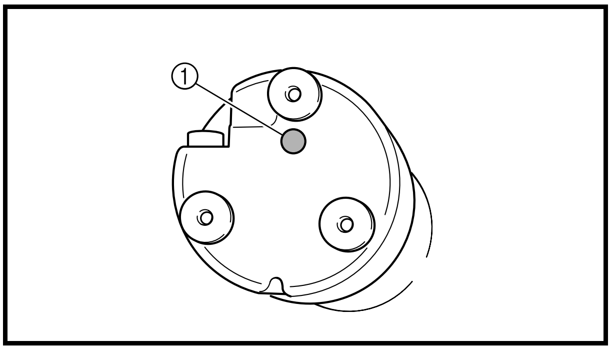
Refer to "FUEL CONTROL SYSTEM" in Chapter 7.

**Fuel tank inspection**

1. Inspect:
   - Fuel tank
     Cracks/damage → Replace.

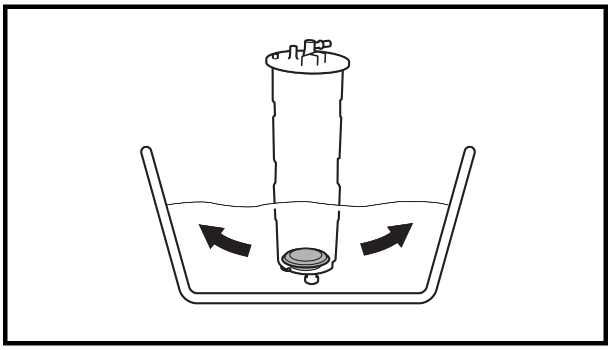
**Fuel hose inspection**

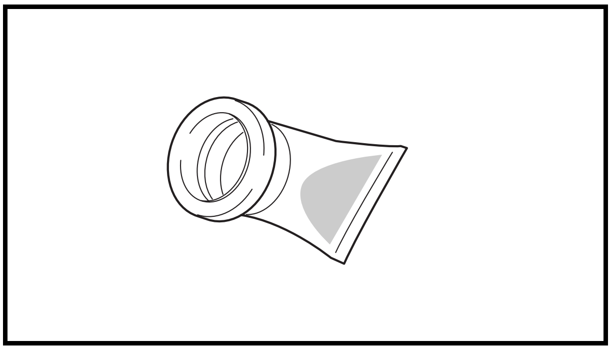
Refer to "FUEL INJECTION SYSTEM".




**Fuel pump filter inspection**

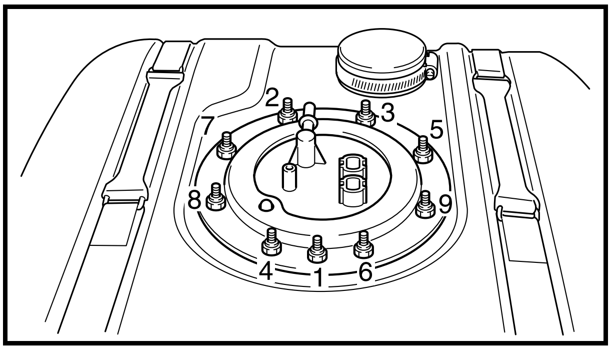
1. Inspect:
   - Fuel pump filter ①
     Clog/contaminants → Wash the fuel pump filter in kerosene or gasoline.





**Fuel strainer inspection**

1. Inspect:
   - Fuel strainer
     Clog/contaminants → Clean.




**Fuel pump module installation**

1. Tighten:
   - Nuts

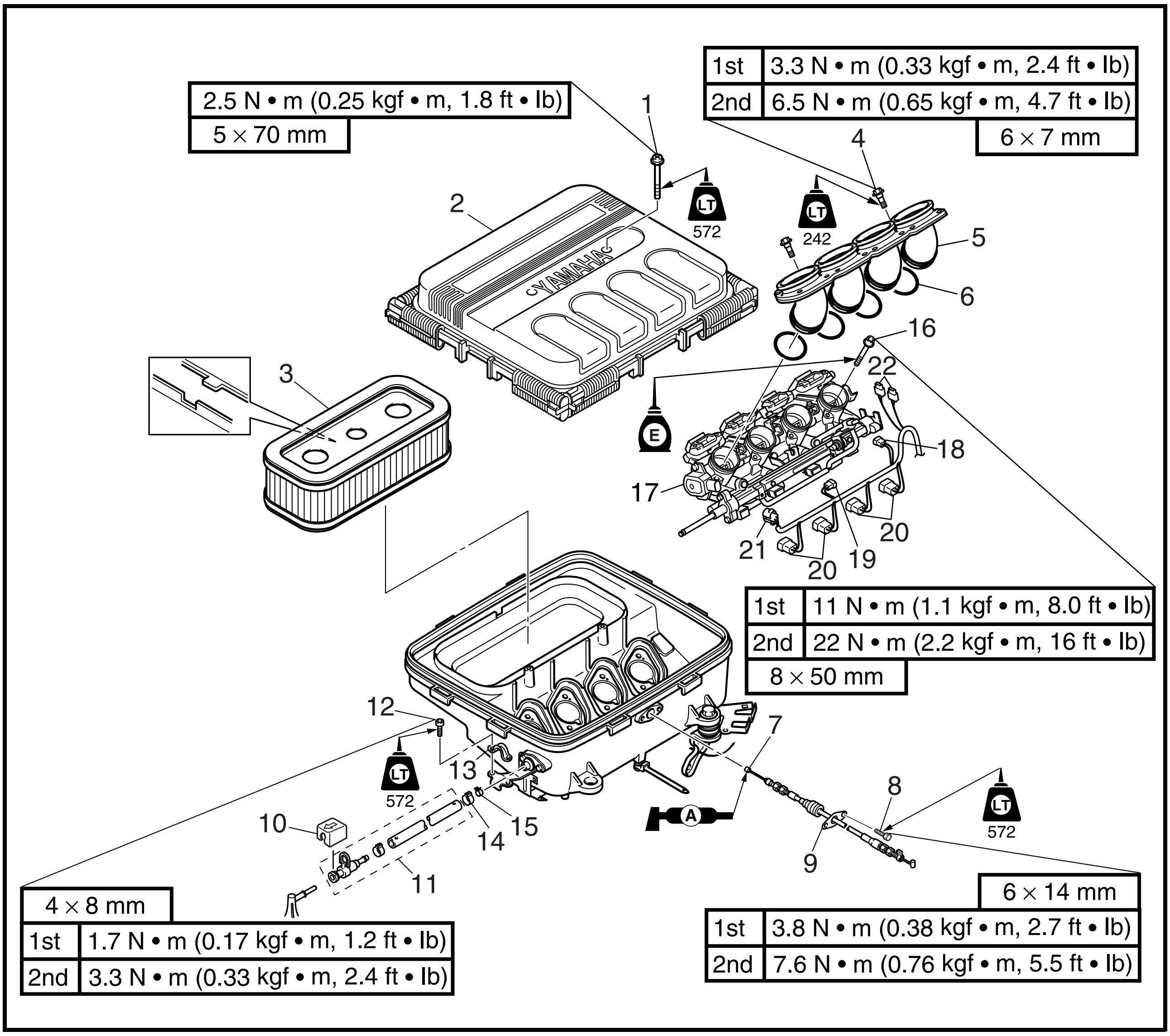
| |
|---|
| **Fuel pump module nut:**<br>**1st:**<br>**3.2 N • m**<br>**(0.32 kgf • m, 2.3 ft • lb)**<br>**2nd:**<br>**6.4 N • m**<br>**(0.64 kgf • m, 4.6 ft • lb)** |

**NOTE:**
Tighten the nuts in the sequence shown.

**Fuel hose connect**

Refer to "FUEL INJECTION SYSTEM".

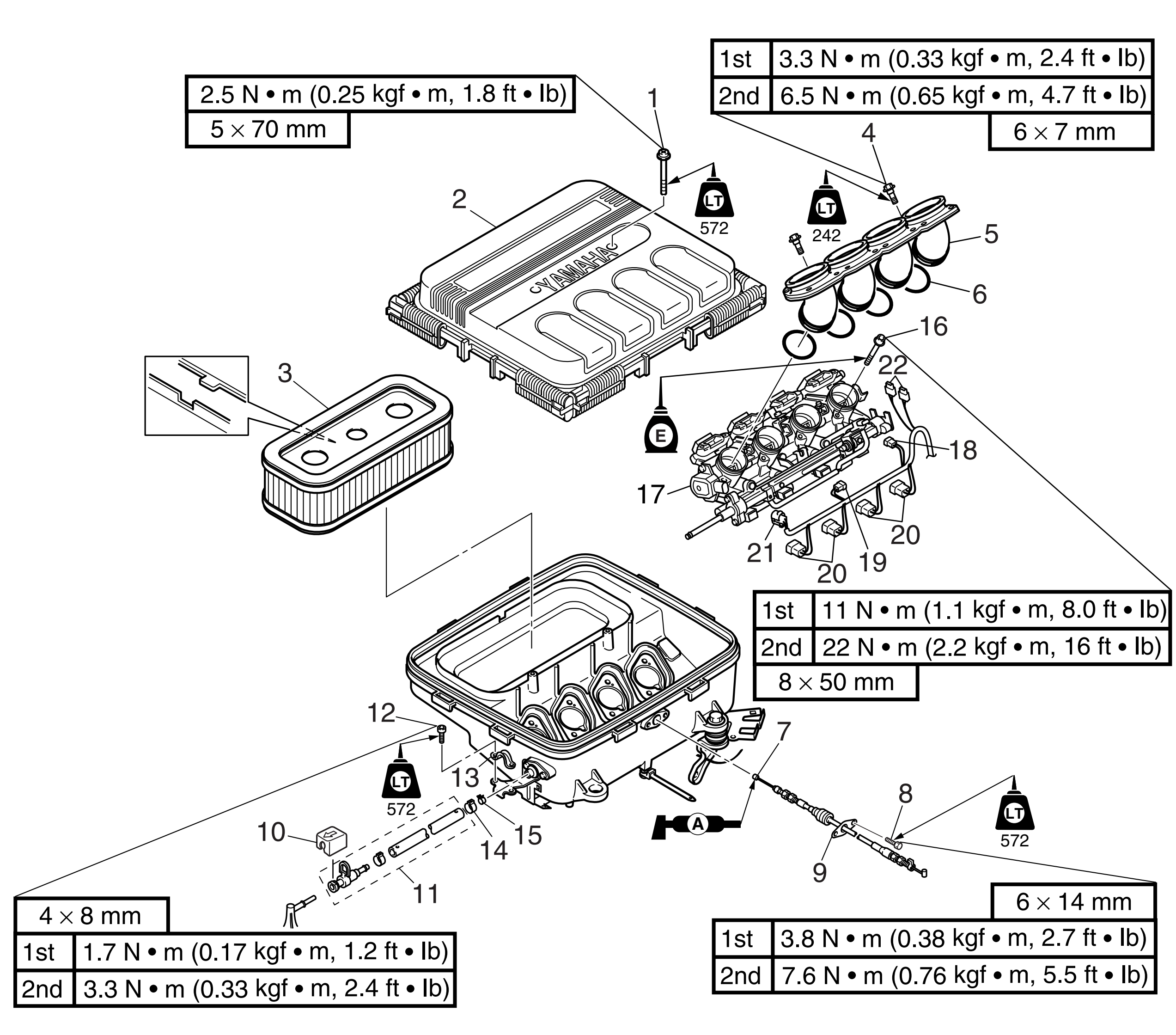
# FUEL INJECTION SYSTEM
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

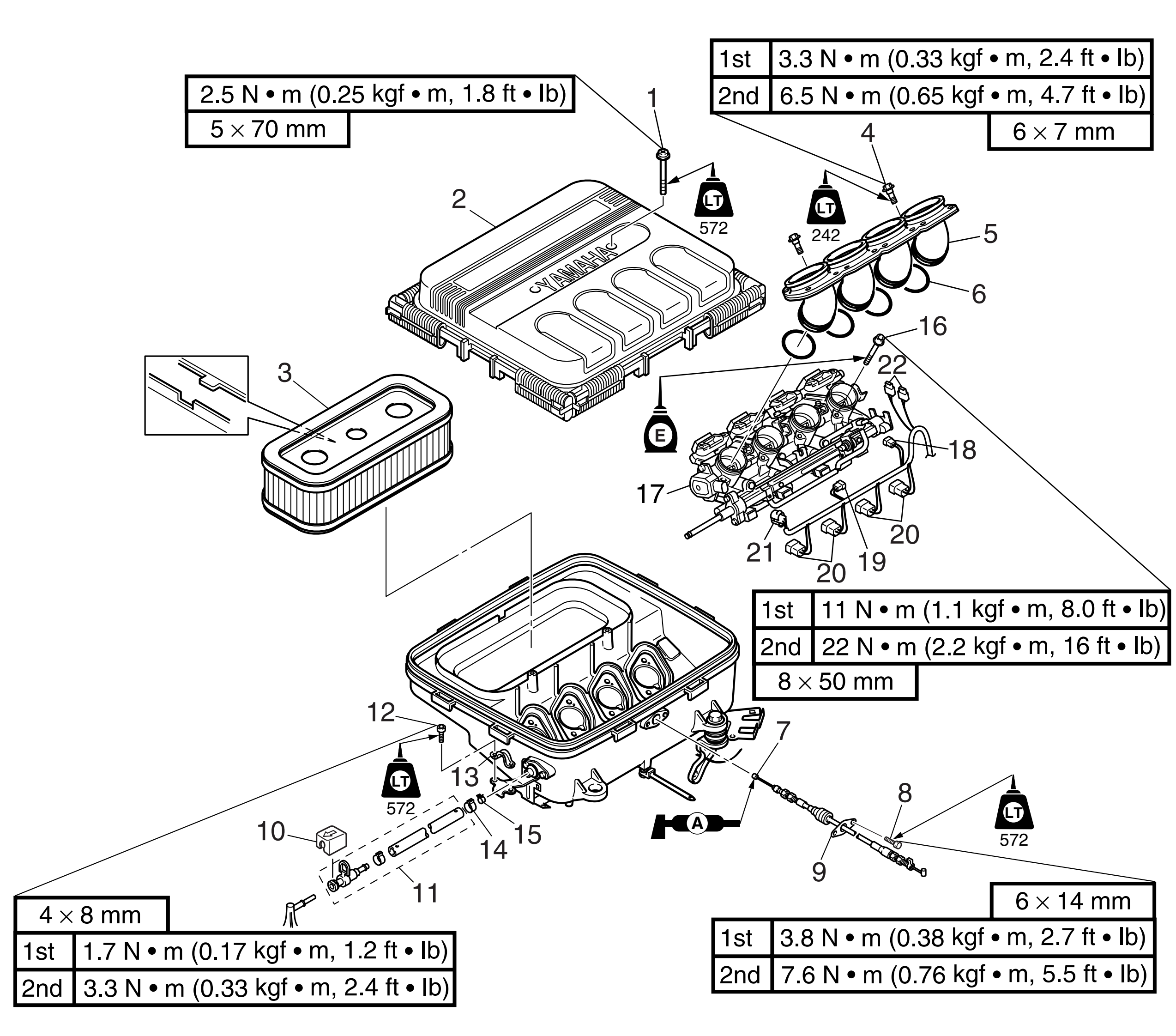
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **THROTTLE BODIES REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Screw | 2 | |
| 2 | Air filter case cover | 1 | |
| 3 | Air filter | 1 | |
| 4 | Bolt | 4 | |
| 5 | Flame arrester | 1 | **NOTE:** When removing the flame arrester, slide the springs off. |
| 6 | Spring | 4 | |

## EXPLODED DIAGRAM



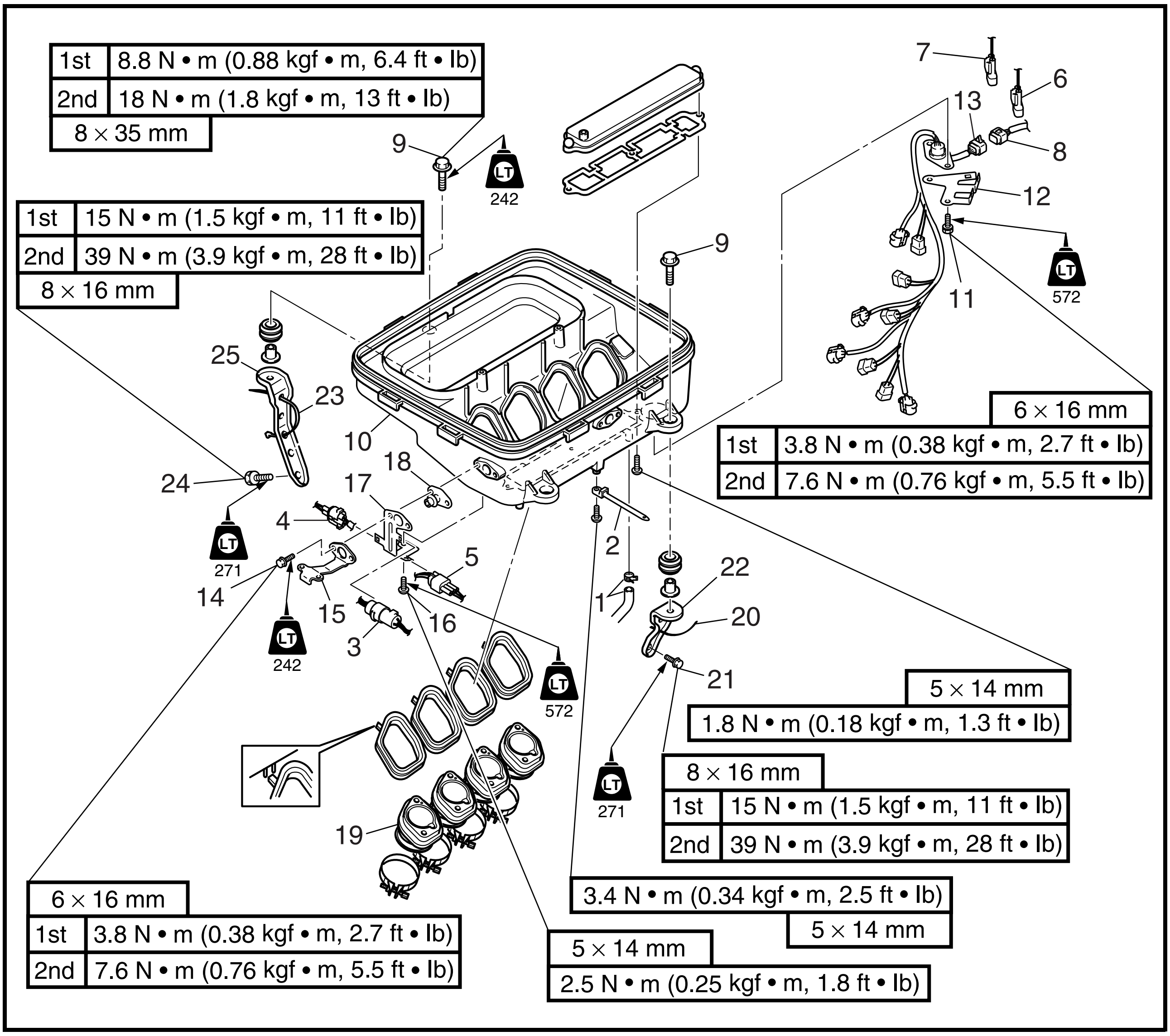

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Throttle cable | 1 | |
| 8 | Bolt | 2 | |
| 9 | Throttle cable holder | 1 | |
| 10 | Cover | 1 | |
| 11 | Fuel hose | 1 | |
| 12 | Bolt | 2 | |
| 13 | Fuel hose holder | 1 | |
| 14 | Clamp | 1 | Not reusable |
| 15 | Clamp | 1 | |
| 16 | Bolt | 8 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 17 | Throttle bodies | 1 | |
| 18 | Intake air pressure sensor coupler | 1 | |
| 19 | Intake air temperature sensor coupler | 1 | |
| 20 | Fuel injector coupler | 4 | |
| 21 | Throttle position sensor coupler | 1 | |
| 22 | Joint connector | 2 | |
| | | | Reverse the removal steps for installation. |

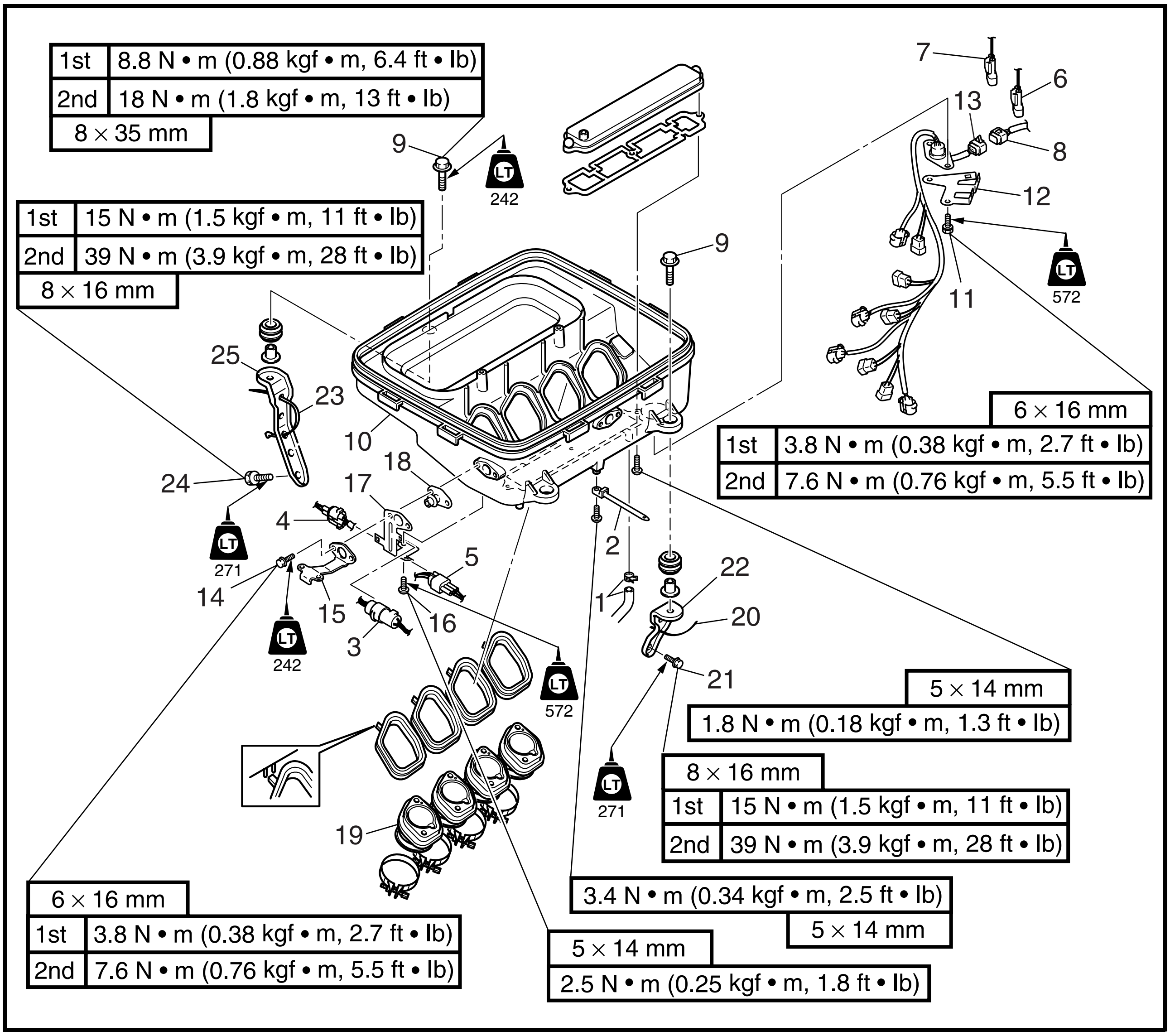
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

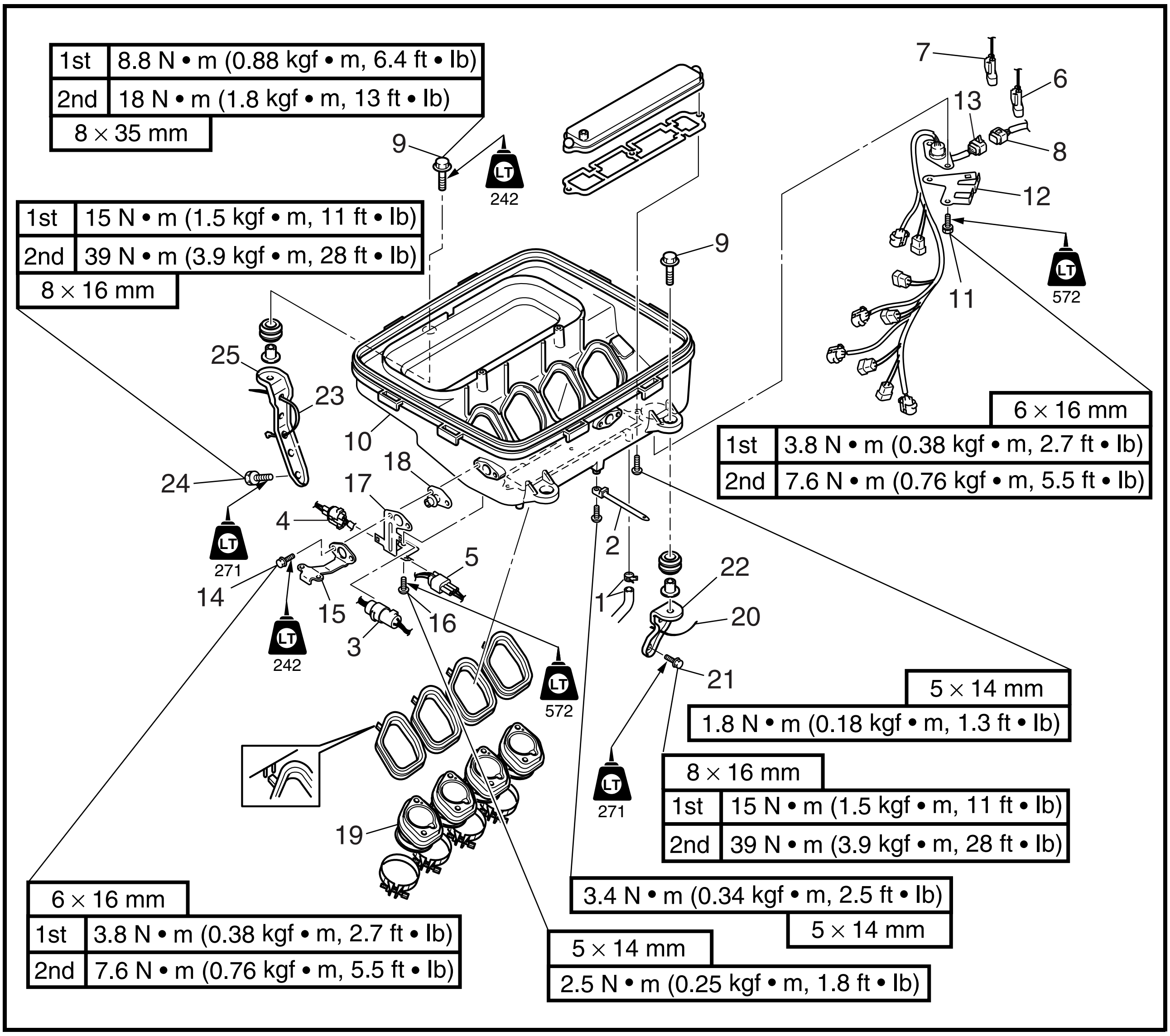
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **AIR FILTER CASE REMOVAL** | | Follow the left "Step" for removal. |
| | Throttle bodies | | |
| 1 | Clamp/breather hose | 1/1 | |
| 2 | Band | 1 | Unfasten the wire harness. |
| 3 | Lighting coil coupler | 1 | From wire harness bracket 2 |
| 4 | Thermoswitch coupler (engine) | 1 | From wire harness bracket 2 |
| 5 | Pulser coil coupler | 1 | From wire harness bracket 2 |
| 6 | Thermoswitch coupler (exhaust) | 1 | From wire harness bracket 1 |
| 7 | Camshaft position sensor coupler | 1 | From wire harness bracket 1 |

## EXPLODED DIAGRAM



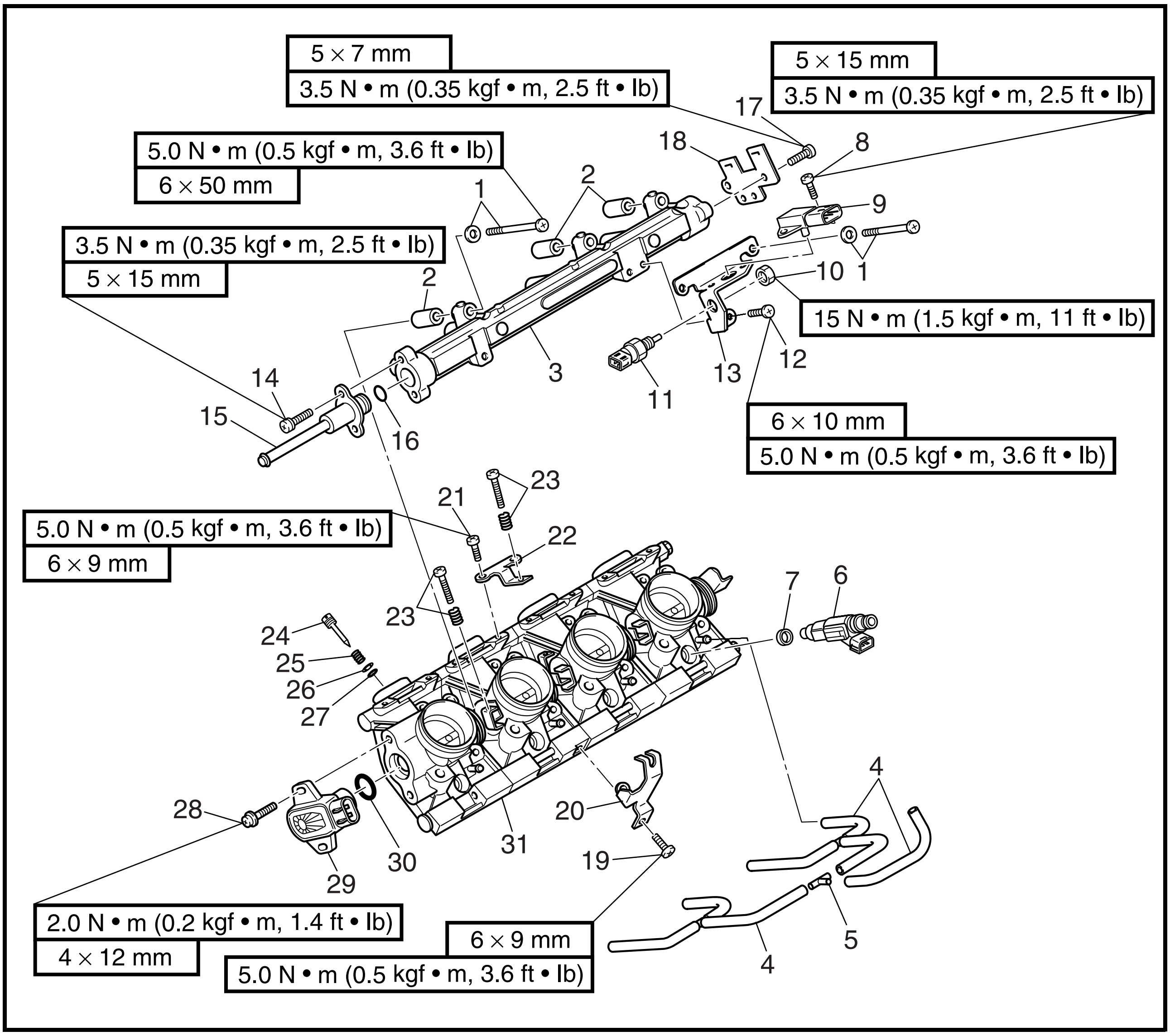

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Wire harness coupler | 1 | |
| 9 | Bolt | 3 | |
| 10 | Air filter case | 1 | |
| 11 | Bolt | 2 | |
| 12 | Wire harness bracket 1 | 1 | |
| 13 | Sub wire harness | 1 | |
| 14 | Bolt | 2 | |
| 15 | Fuel hose bracket | 1 | |
| 16 | Screw | 1 | |
| 17 | Wire harness bracket 2 | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 18 | Grommet | 1 | |
| 19 | Throttle body joint | 4 | |
| 20 | Band | 2 | |
| 21 | Bolt | 2 | |
| 22 | Air filter case stay 1 | 2 | |
| 23 | Band | 1 | |
| 24 | Bolt | 1 | |
| 25 | Air filter case stay 2 | 1 | |
| | | | Reverse the removal steps for installation. |

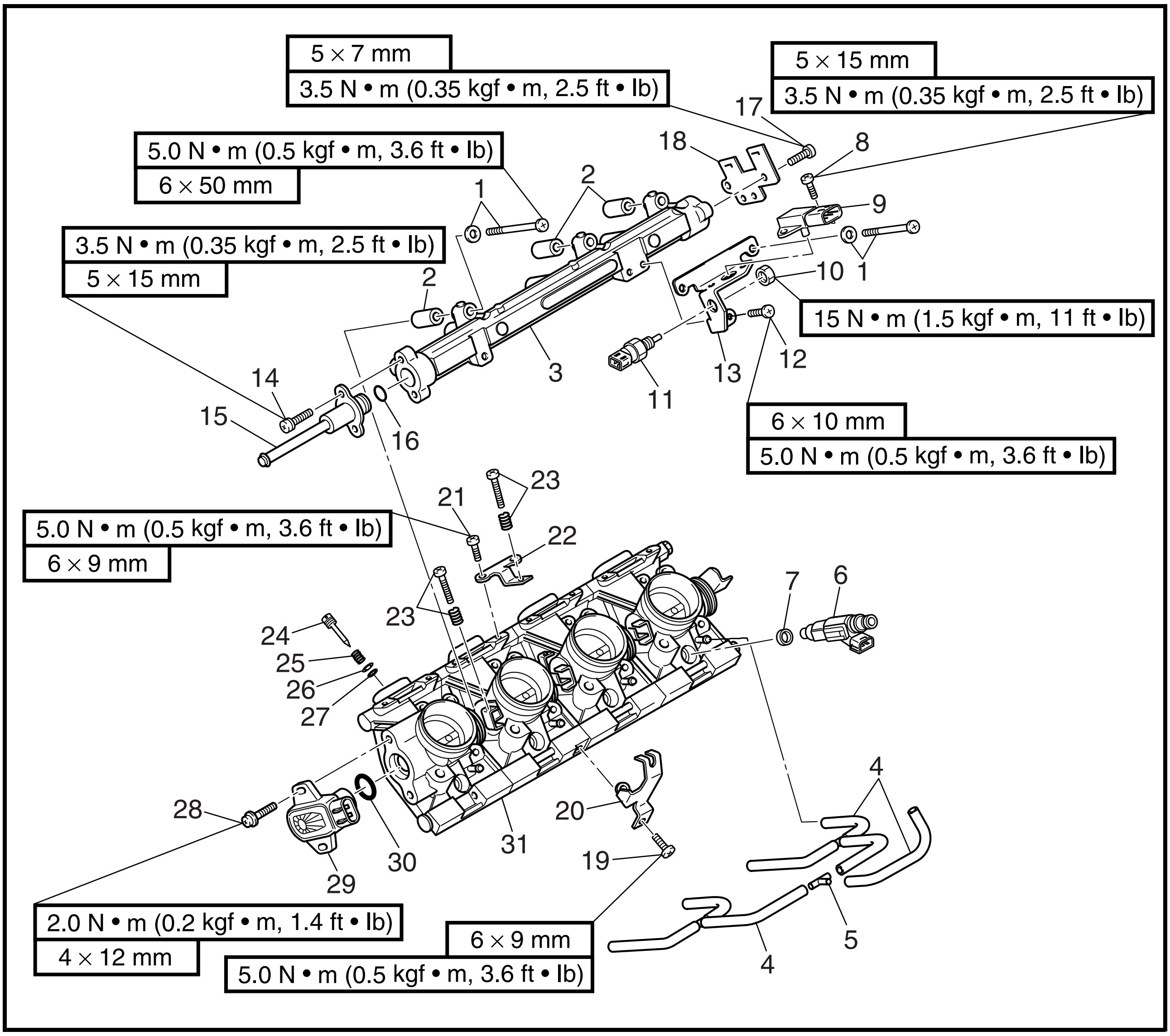
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

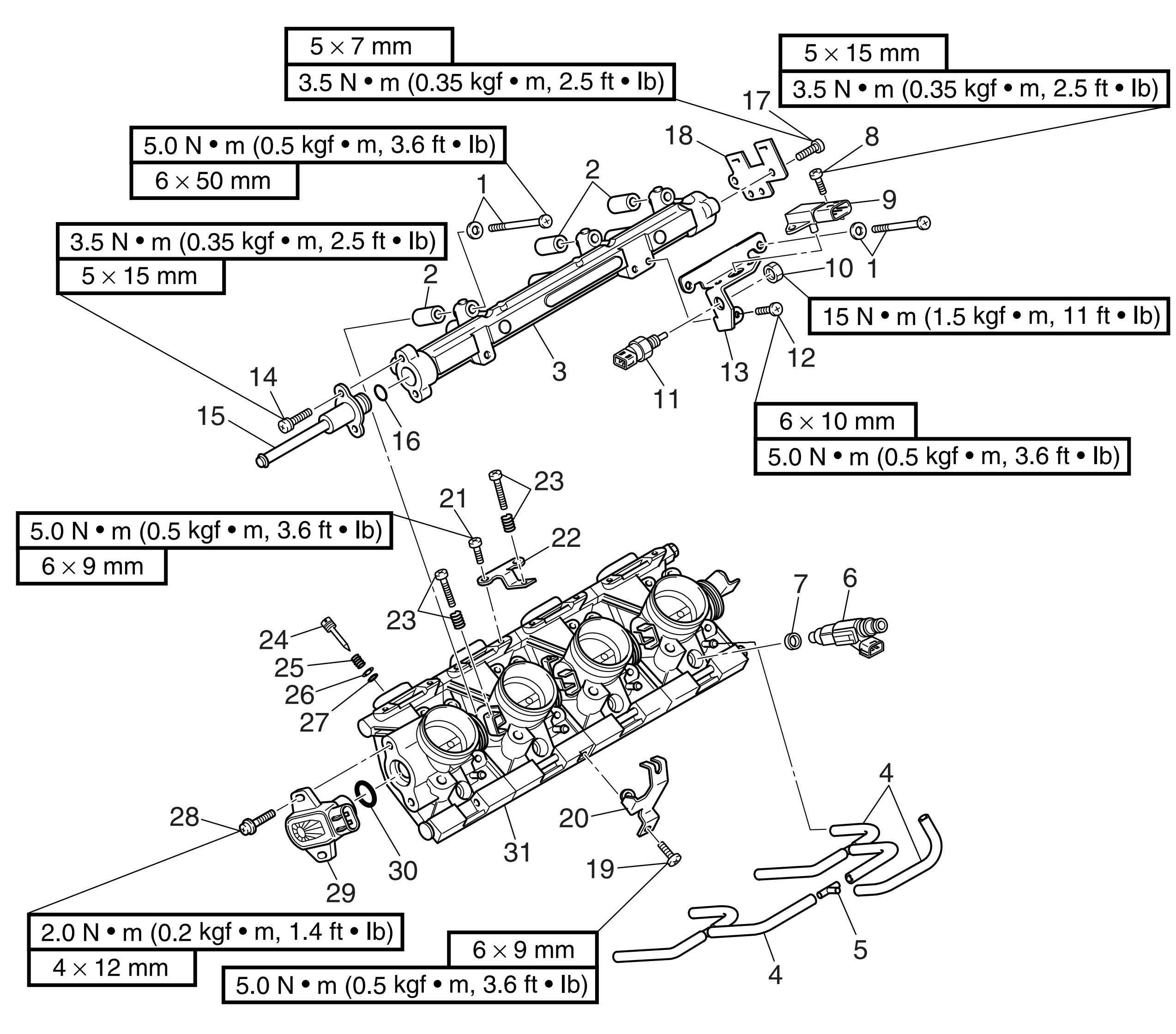
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **THROTTLE BODY DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Screw/washer | 3/3 | |
| 2 | Spacer | 3 | |
| 3 | Fuel rail | 1 | |
| 4 | Intake vacuum hose | 3 | |
| 5 | Joint | 1 | |
| 6 | Injector | 4 | |
| 7 | Grommet | 4 | **Not reusable** |
| 8 | Screw | 2 | |
| 9 | Intake air pressure sensor | 1 | |
| 10 | Nut | 1 | |

## EXPLODED DIAGRAM

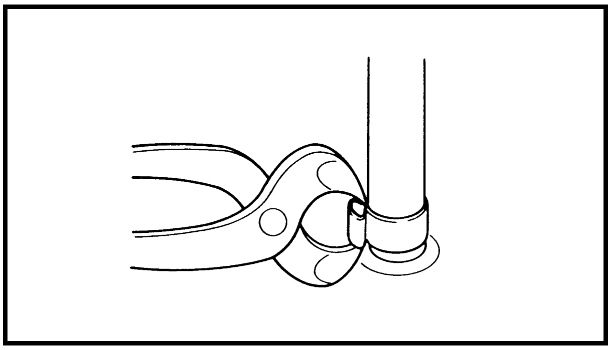


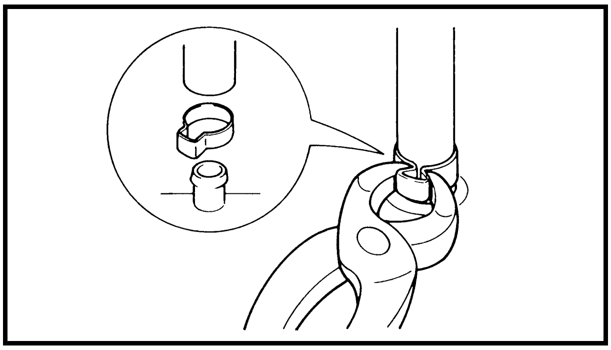

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 11 | Intake air temperature sensor | 1 | |
| 12 | Screw | 1 | |
| 13 | Bracket 1 | 1 | |
| 14 | Screw | 2 | |
| 15 | Fuel pipe | 1 | |
| 16 | O-ring | 1 | **Not reusable** |
| 17 | Screw | 2 | |
| 18 | Bracket 2 | 1 | |
| 19 | Screw | 2 | |
| 20 | Throttle stop guide | 1 | |
| 21 | Screw | 2 | |
| 22 | Throttle stop screw bracket | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 23 | Screw/spring | 4/4 | |
| 24 | Bypass air screw | 4 | |
| 25 | Spring | 4 | |
| 26 | Washer | 4 | |
| 27 | O-ring | 4 | **Not reusable** |
| 28 | Screw | 2 | |
| 29 | Throttle position sensor | 1 | |
| 30 | O-ring | 1 | **Not reusable** |
| 31 | Throttle bodies | 1 | |
| | | | Reverse the disassembly steps for assembly. |





## SERVICE POINTS

### Hose clamps removal

1. Remove:
   - Hose clamps

**CAUTION:**

**If the hose clamps are removed without cutting the joint first, the fuel hose will be damaged.**

### Hose clamps installation

1. Install:
   - Hose clamps

**⚠ WARNING**

**Do not reuse the hose clamps, always replace them with new ones.**

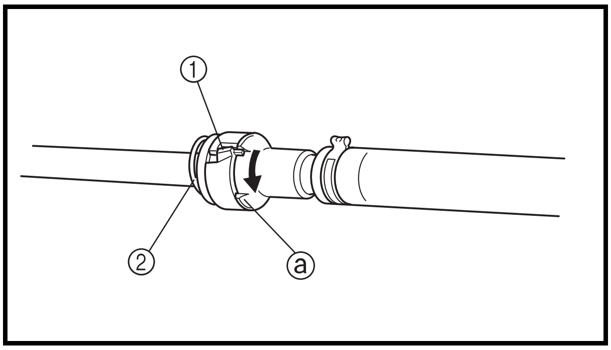
**NOTE:**

Crimp the hose clamps properly to securely fasten them.

### Fuel hose disconnection

**⚠ WARNING**

**Before disconnecting the hose, remove the fuel tank filler cap to reduce any pressure inside the fuel tank, and then disconnect the battery negative lead to cut off the electric current to the electrical systems.**



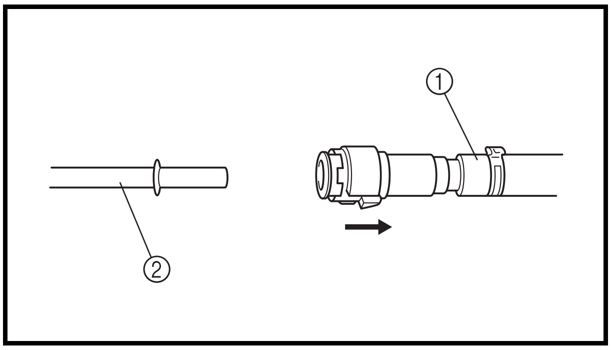

1. Wrap the quick connector with a cloth, and then rotate the quick connector tab ① to the stopper position ⓐ.

**⚠ WARNING**

**If the quick connector is removed suddenly, pressurized fuel could spray out. To gradually release the fuel pressure, be sure to remove the quick connector slowly.**

**CAUTION:**

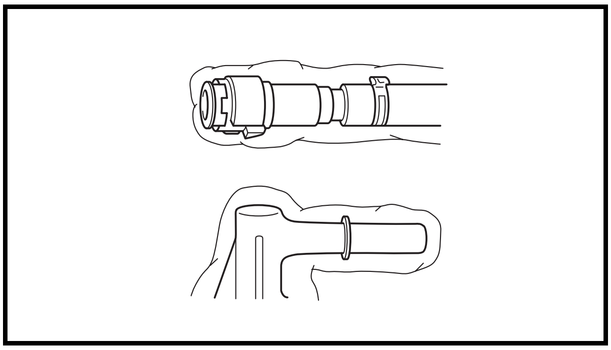
- **Do not rotate the quick connector tab ① past the stopper position ⓐ, otherwise it could be damaged.**
- **When the fuel hoses are disconnected, quickly remove the retainer ② from the quick connector, otherwise the retainer could be lost.**




2. Disconnect the fuel hose ① from the fuel pipe ② directly.

**⚠ WARNING**

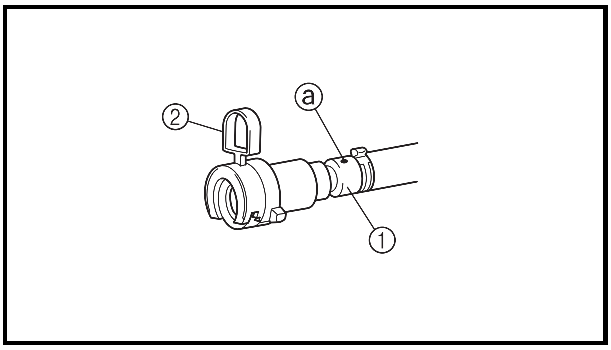
**Always reduce the fuel pressure in the fuel line before servicing the line or the fuel pipe. If the fuel pressure is not released, pressurized fuel could spray out.**

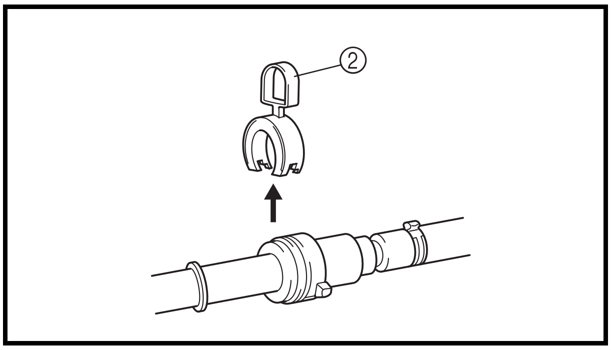


3. Cover the quick connector and fuel pipe with a plastic bag to prevent damage and to protect them from dirt.

**Fuel line inspection**

1. Inspect:
   - Fuel hose
     Damage/cracks → Replace.
   - O-rings (quick connector)
     Damage/cracks → Replace the quick connector.
   - Fuel pipe
     Damage/cracks → Replace the fuel pump.




**Fuel hose installation (replacing with new fuel hose)**

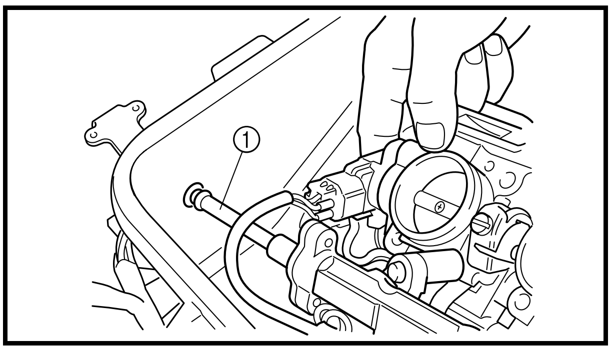
1. Install:
   - Fuel hose ①

**NOTE:**
- To install the fuel hose, be sure to align the white mark ⓐ of the fuel hose with the checker tab ② of the quick connector.
- When replacing the fuel hose with a new one, a checker tab ② that has half engagement prevention is attached to the quick connector of the hose. If the quick connector is completely installed to the fuel pipe, it is removable.

**Fuel hose connection**

1. Apply a thin coat of engine oil to the contact surfaces of the fuel pipe.
2. Insert the quick connector into the fuel pipe until you hear a “click.”
3. To check the connection of the quick connector, push and pull on the quick connector several times until there is free play of 2–3 mm (0.08–0.12 in).

**NOTE:**
If free is not obtained, disconnect the fuel hose and check the O-ring for damage and that it is properly installed.




**Throttle body removal**

1. Remove:
   - Throttle body

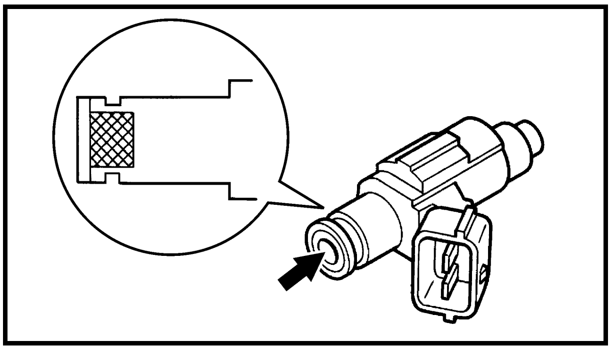
**CAUTION:**

**Do not bend the fuel pipe ①.**

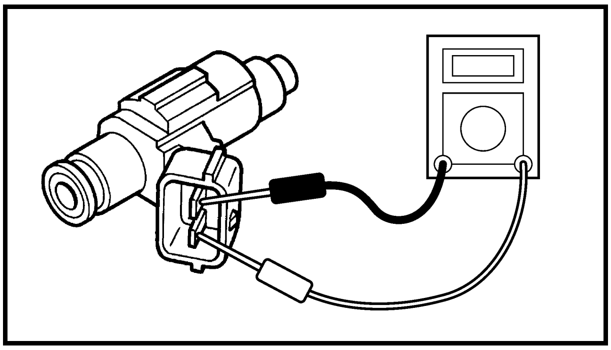
**Fuel injector inspection**

**CAUTION:**

**The throttle bodies should not be disassembled unnecessarily.**



1. Check:
   - Injector
     Dirt/residue → Clean.
     Damage → Replace.



2. Measure:
   - Fuel injectors resistance
     Out of specification → Replace.

**Digital circuit tester:**
**YU-34899-A/90890-03174**

**Fuel injector resistance:**
**14.0–15.0 Ω at 20 °C (68 °F)**

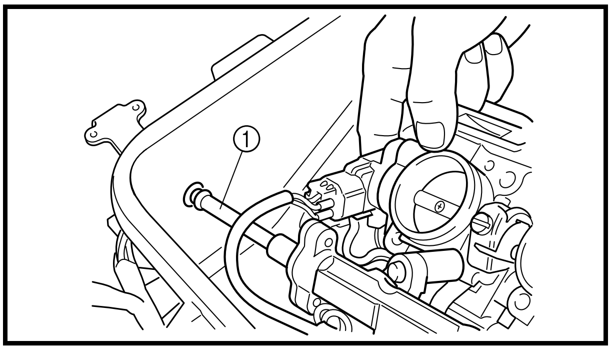
3. Check the operation of the fuel injector using the “Stationary Test” of the Yamaha Diagnostic System.

**Throttle body inspection**

1. Check:
   - Throttle body
     Cracks/damage → Replace the throttle bodies.

2. Check:
   - Fuel passages
     Obstruction → Clean.

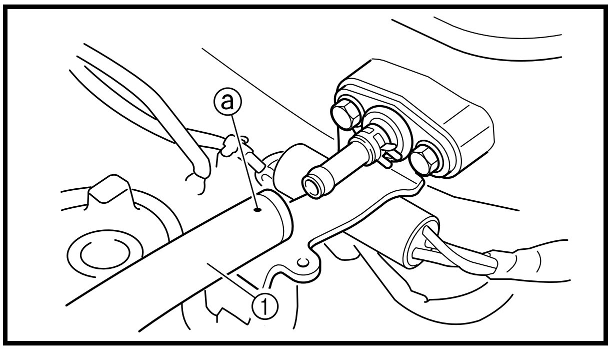
**Checking steps:**
- Wash the throttle body in a petroleum based solvent.
  Do not use any caustic carburetor cleaning solution.
- Blow out all of passages with compressed air.




**Throttle body installation**
1. Install:
   - Throttle body

**CAUTION:**

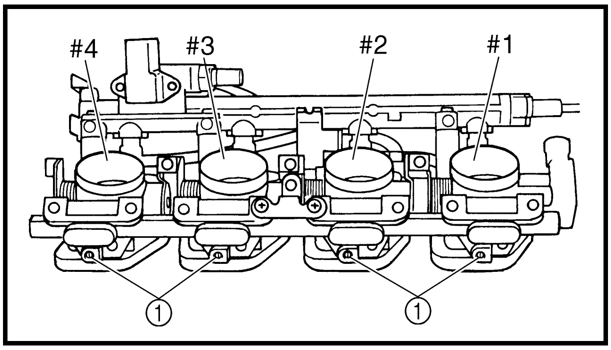
**Do not bend the fuel pipe ①.**

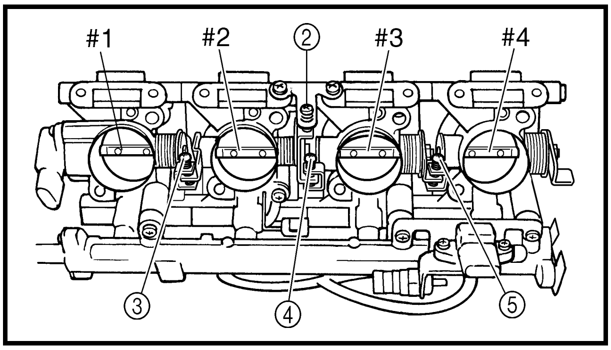



2. Install:
   - Fuel hose ① (throttle body side)
   - Clamp

**NOTE:**
Install the fuel hose with the white mark ⓐ facing up.

3. Adjust:
   - Throttle lever free play
     Refer to “CONTROL SYSTEM” in Chapter 3.




**Throttle bodies synchronization**

1. Remove:
   - Throttle bodies
   - Air filter case
2. Adjust:
   - Throttle bodies synchronization

**Adjustment steps:**

**NOTE:**
The bypass air screw ① should not be adjusted. However, if it is necessary to remove the bypass air screw, be sure to note the number of times the screw is turned from its set position. When installing the screw, be sure to tighten the screw the same number of turns as noted at removal. If the number of turns is not known, turn the screw approximately 2.5 times counter-clockwise from the fully closed position.

**CAUTION:**

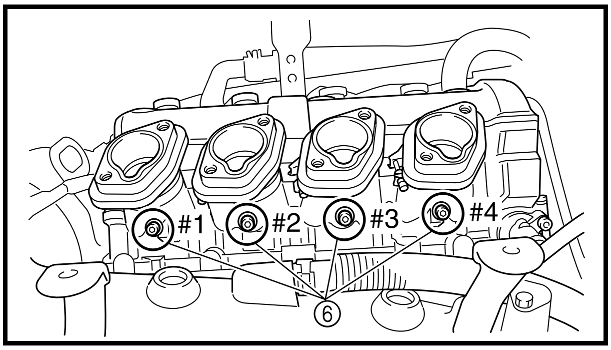
**Do not start the engine when removing the fuel hose. Fuel can spurt out when the fuel pump is operated.**

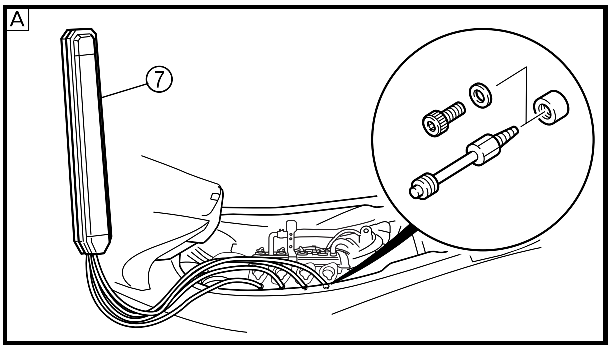
a. Loosen the throttle stop screw ② and synchronizing screws #1 ③, #2 ④, and #3 ⑤ until released from the levers.

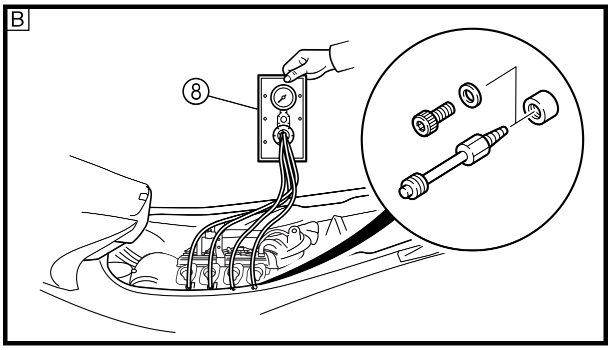
**NOTE:**
- Only butterfly valve #2 should be fully closed and the other valves should be halfway closed.
- Check the valve for light leaks with a flashlight. If there are no light leaks, the valve is fully closed.

b. Turn synchronizing screw #2 ④ clockwise approximately 7 times until it starts to contact the lever.

**NOTE:**
- Butterfly valves #2 and #3 should be fully closed. Butterfly valve #2 opens if the screw is turned more than 7 times.
- If butterfly valves #2 and #3 are not fully closed, close the valves by adjusting synchronizing screw #2 ④.




c. Turn synchronizing screw #1 ③ clockwise approximately 7 times until it starts to contact the lever.

**NOTE:**
- Butterfly valve #1 should be fully closed. Butterfly valves #2 and #3 open if the screw is turned more than 7 times.
- If butterfly valves #1, #2, and #3 are not fully closed, close the valves by adjusting synchronizing screw #1 ③.

d. Turn synchronizing screw #3 ⑤ clockwise approximately 7 times until it starts to contact the lever.

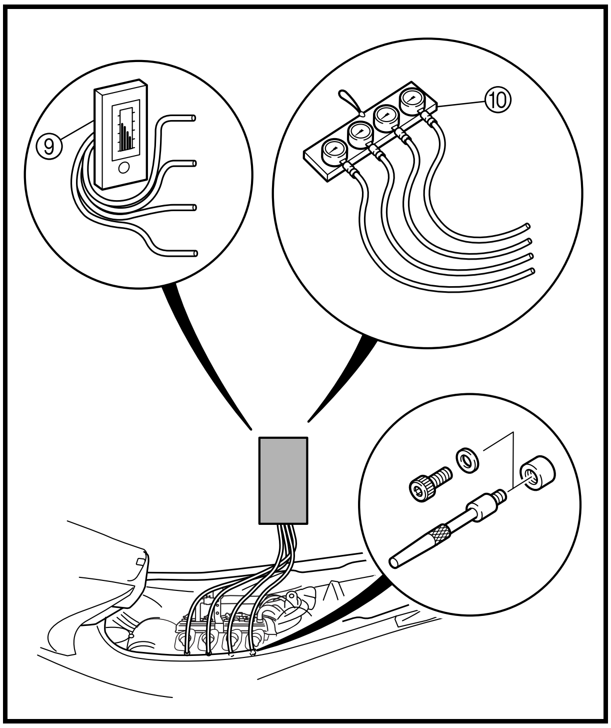
**NOTE:**
- Butterfly valve #4 should be fully closed. Butterfly valves #1, #2, and #3 open if the screw is turned more than 7 times.
- If all butterfly valves are not fully closed, close the valves by adjusting synchronizing screw #3 ⑤.

e. Check that all butterfly valves are fully closed and that they open simultaneously.

**NOTE:**
If all butterfly valves are not fully closed, close the valves by repeating steps a–d.

f. Turn the throttle stop screw ② clockwise approximately 1.5 times until it starts to contact the throttle lever.
g. Remove the plugs ⑥.
h. Install the carburetor synchronizer ⑦ or vacuum gauge ⑧.

**Carburetor synchronizer:**
**YU-08030**
**Vacuum gauge:**
**90890-03094**



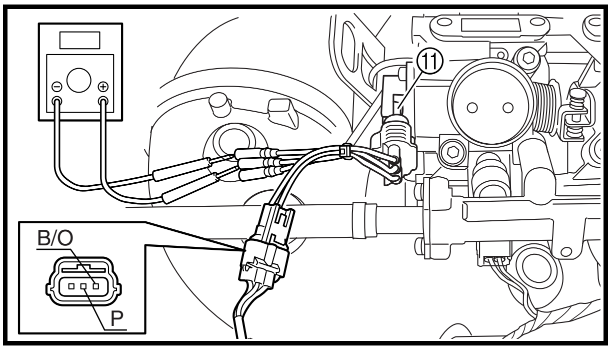

**NOTE:**
For best results, use a vacuum gauge (commercially obtainable), like ⑨ or ⑩ shown in the illustration, that has four adapters.

Ⓐ For USA and Canada
Ⓑ For worldwide

i. Install the throttle bodies.

**NOTE:**
Adjust the throttle body synchronization with the air filter case uninstalled.

j. Connect the fuel hose and clamp.
k. Connect the Yamaha Diagnostic System.
l. Remove the sub wire harness from the air filter case, and then connect it to the throttle bodies and main wire harness.
m. Connect the test harness (3 pin) to the throttle position sensor ⑪.

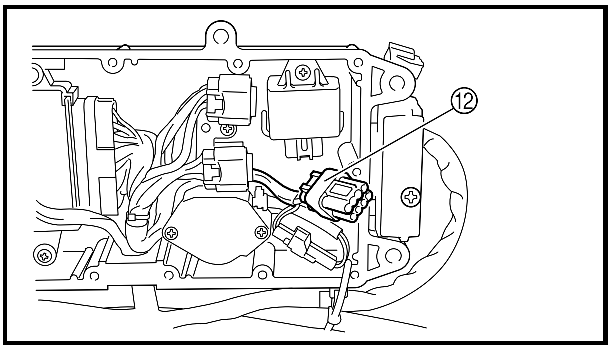



**Test harness (3 pins):**
**YB-06793/90890-06793**

n. To start the ECM normally, start the Yamaha Diagnostic System.

**CAUTION:**

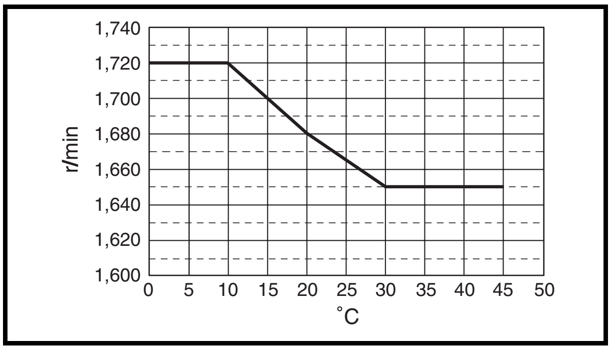
**If the Yamaha Diagnostic System and ECU are started, fuel can spurt out. Be sure to connect the fuel hoses and throttle bodies when adjusting the throttle position sensor.**




**NOTE:**
Use the test connector ⑫ to start the ECU normally only if the Yamaha Diagnostic System is not available.

**Test connector:**
**YW-06862/90890-06862**

o. Measure the throttle position sensor output voltage (DC). Adjust the throttle position sensor ⑪ position if out of specification.




**Throttle position sensor output voltage:**
**Pink (P) – Black/Orange (B/O)**
**0.8 ± 0.1 V**

**NOTE:**
- To decrease the output voltage, turn the throttle position sensor clockwise.
- Slightly tighten the throttle position screw.

p. Start the engine and let it run at trolling speed for 20 minutes.

**NOTE:**
- Warm the engine up in the water.
- While checking the engine temperature with the Yamaha Diagnostic System, warm the engine up until the engine temperature is 50 °C (122 °F).

q. Adjust the throttle stop screw ② until trolling speed is within specification.

**Trolling speed:**

| Season | Temperature | Specified engine speed |
|---|---|---|
| Summer | 30 °C (86 °F) or more | 1,650 r/min |
| Winter | 10 °C (50 °F) or less | 1,720 r/min |
| Spring/ Fall | 20 °C (68 °F) | 1,680 r/min |

r. Adjust each cylinder to the cylinder differences shown in the table using synchronizing screws ③–⑤ and using cylinder #2 as the standard.

**Vacuum pressure at trolling speed:**

| Cylinder | Cylinder difference | Example |
|---|---|---|
| #1 | –30 ± 10 mmHg (–4.00 ± 1.33 kPa, –1.2 ± 0.4 inHg) | –210 ± 10 mmHg (–27.99 ± 1.33 kPa, –8.3 ± 0.4 inHg) |
| #2 | Standard*0 | –180 mmHg (–23.99 kPa, –7.1 inHg) |
| #3 | 0 ± 10 mmHg (0 ± 1.33 kPa, 0 ± 0.4 inHg) | –180 ± 10 mmHg (–23.99 ± 1.33 kPa, –7.1 ± 0.4 inHg) |
| #4 | –20 ± 10 mmHg (–2.67 ± 1.33 kPa, –0.8 ± 0.4 inHg) | –200 ± 10 mmHg (–26.66 ± 1.33 kPa, –7.8 ± 0.4 inHg) |

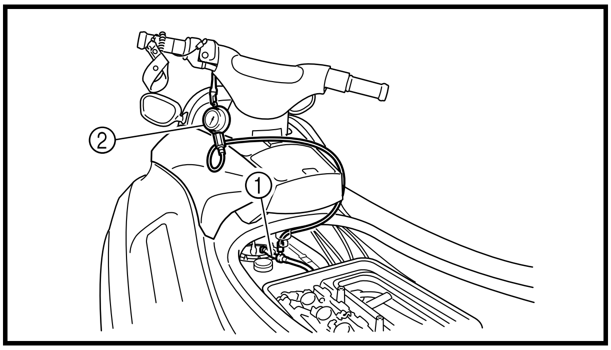
Standard*: When setting the specified engine speed, the value is zero.

**NOTE:**
Always maintain the specified trolling speed when making this adjustment.

s. Measure the throttle position sensor output voltage. Adjust the throttle position sensor ⑪ position if out of specification.

**Throttle position sensor output voltage:**
**Pink (P) – Black/Orange (B/O)**
**0.760 ± 0.016 V**

3. Remove:
   - Throttle bodies
   - Air filter case
4. Remove:
   - Carburetor synchronizer or vacuum gauge
5. Install:
   - Plugs
6. Install:
   - Air filter case
   - Throttle bodies




**Fuel pressure measurement**

1. Disconnect:
   - Fuel hose
     Refer to “Fuel hose disconnection”.
2. Install:
   - Fuel pressure gauge adapter ①
   - Fuel pressure gauge ②

**Fuel pressure gauge adapter:**
**YW-06842/90890-06842**
**Fuel pressure gauge:**
**YB-06766/90890-06786**

**NOTE:**
To connect the fuel pressure gauge adapter, follow the procedures for connecting a fuel hose. (Refer to “Fuel hose connection”.)

3. Start the engine and arrow it to warm up for several minutes.
4. Measure:
   - Fuel pressure
     Out of specification → Replace the fuel pump module.

**Fuel pressure:**
**310–330 kPa**
**(3.1–3.3 kgf/cm$^2$, 45–47 psi)**

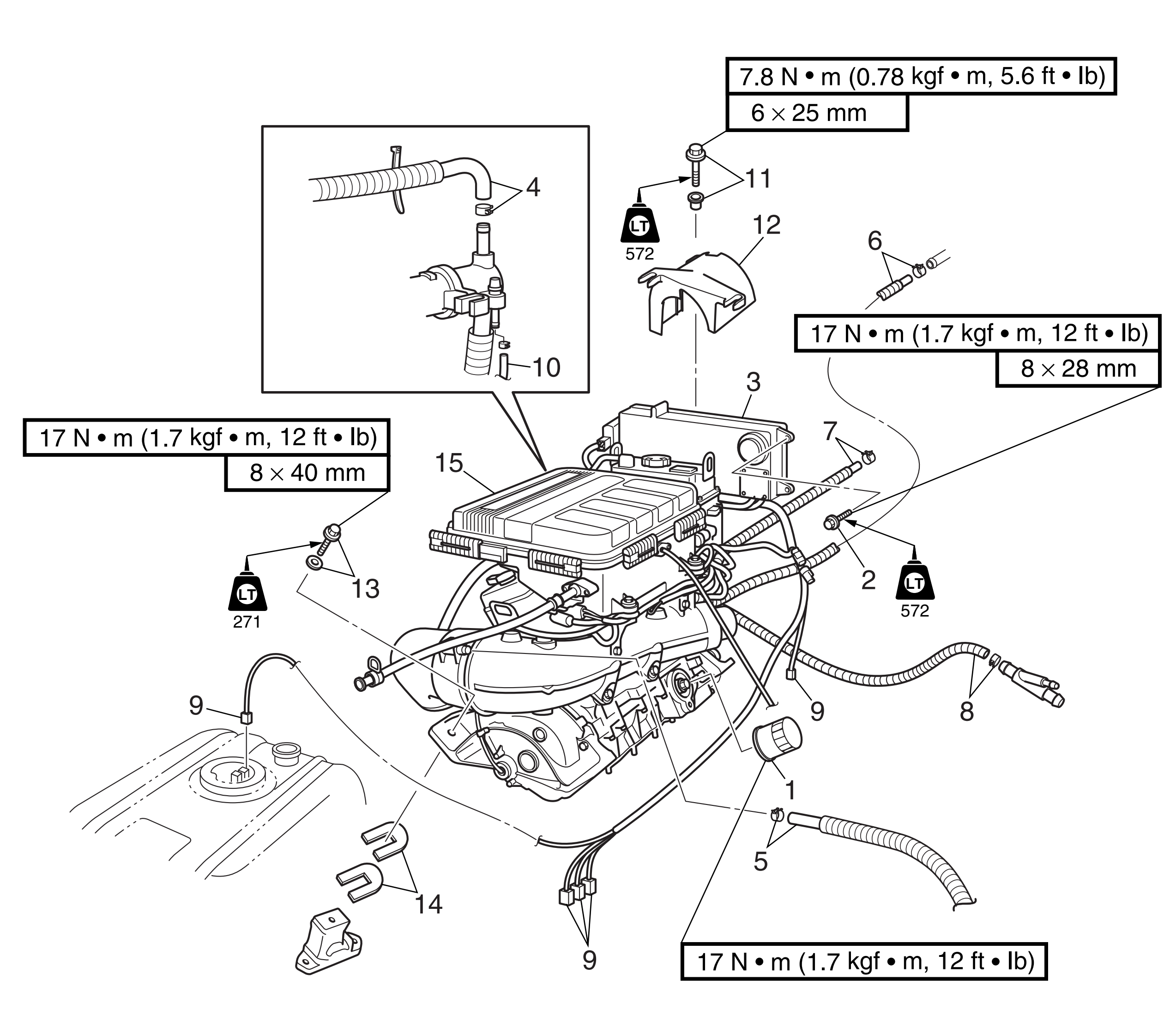
5. Remove:
   - Fuel pressure gauge
   - Fuel pressure gauge adapter

**NOTE:**
To disconnect the fuel pressure gauge adapter, follow the procedures for disconnecting a fuel hose. (Refer to “Fuel hose disconnection”.)

6. Connect:
   - Fuel hose
     Refer to “Fuel hose connection”.

# CHAPTER 5
# POWER UNIT

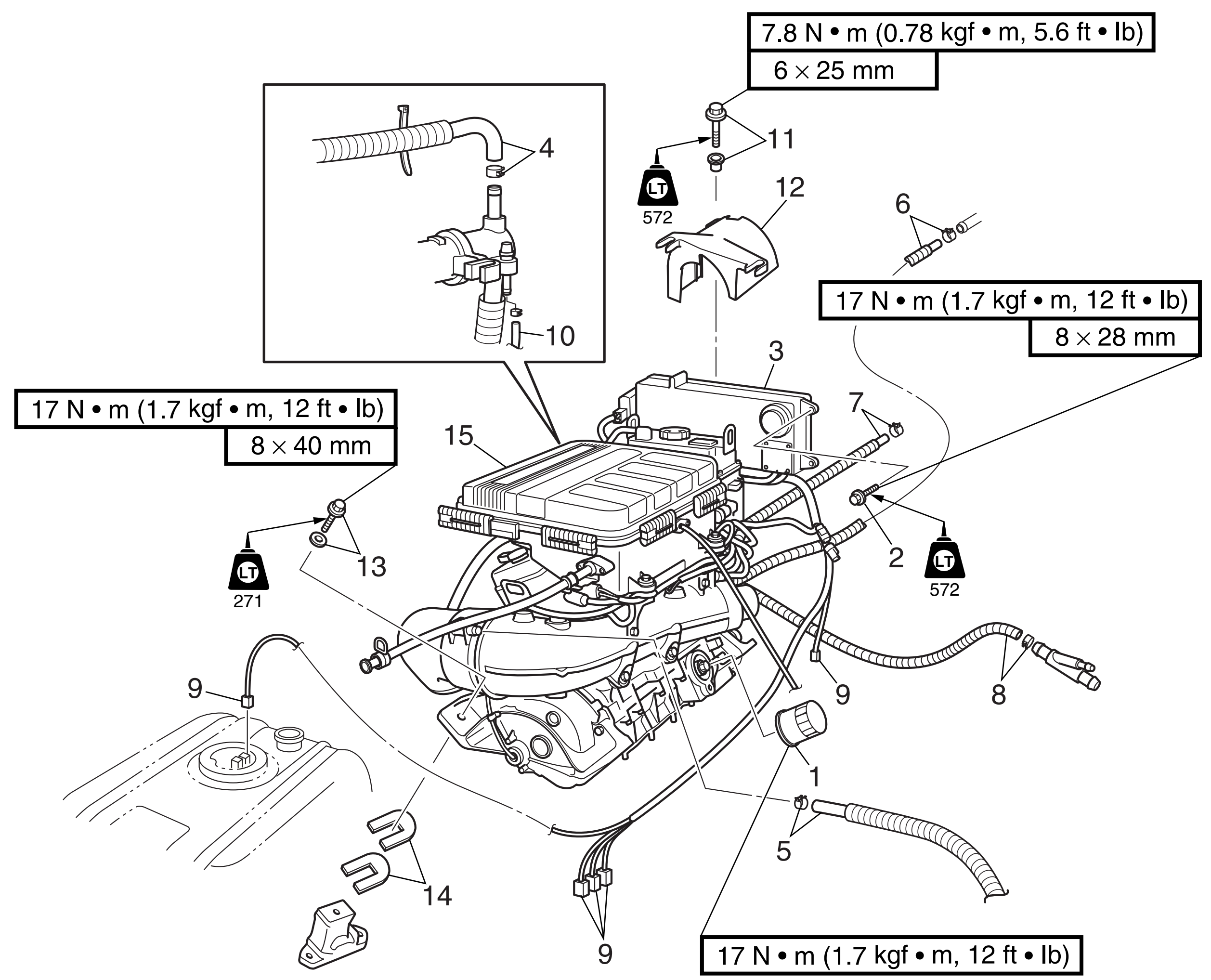
# ENGINE UNIT
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

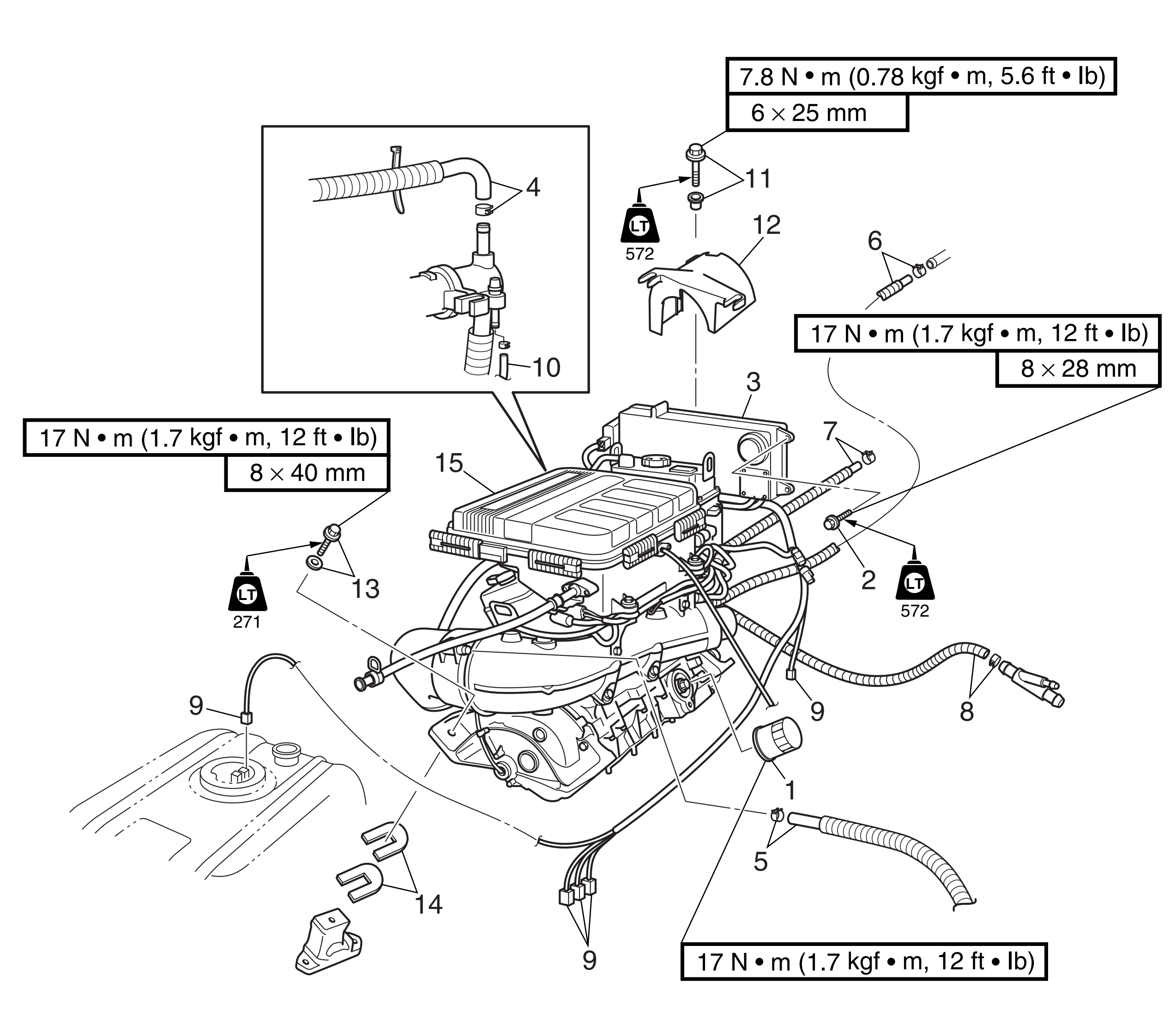
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **ENGINE UNIT REMOVAL** | | Follow the left "Step" for removal. |
| | Engine oil | | Drain.<br>Refer to "POWER UNIT" in Chapter 3. |
| | Service lid 1 | | Refer to "FRONT HOOD" in Chapter 8. |
| | Battery negative and positive lead | | Refer to "ELECTRICAL BOX AND IGNITION COIL BOX" in Chapter 7. |
| | Throttle cable and fuel hose | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| | Water lock and exhaust joint | | Refer to "EXHAUST SYSTEM" in Chapter 8. |
| 1 | Oil filter | 1 | |
| 2 | Bolt | 4 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 3 | Electrical box | 1 | |
| 4 | Clamp/cooling water hose | 1/1 | Cooling water pilot outlet |
| 5 | Clamp/cooling water hose | 1/1 | Cooling water pilot outlet |
| 6 | Clamp/cooling water hose | 1/1 | Cooling water outlet |
| 7 | Clamp/cooling water hose | 1/1 | Cooling water outlet |
| 8 | Clamp/cooling water hose | 1/1 | Cooling water inlet |
| 9 | Coupler | 5 | |
| 10 | Grease hose | 1 | |
| 11 | Bolt/collar | 1/1 | |
| 12 | Coupling cover | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 13 | Bolt/washer | 4/4 | |
| 14 | Shim | * | |
| 15 | Engine unit | 1 | |
| | | | Reverse the removal steps for installation. |

*: As required.

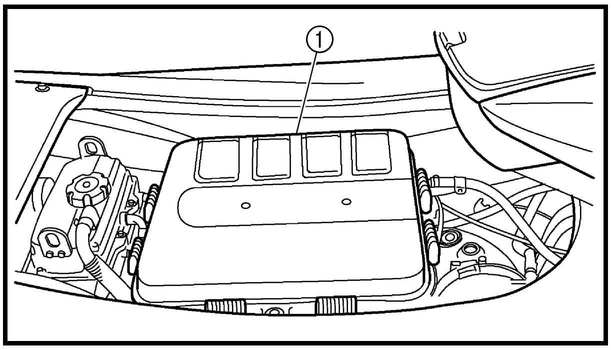
## SERVICE POINTS

### Compression pressure measurement

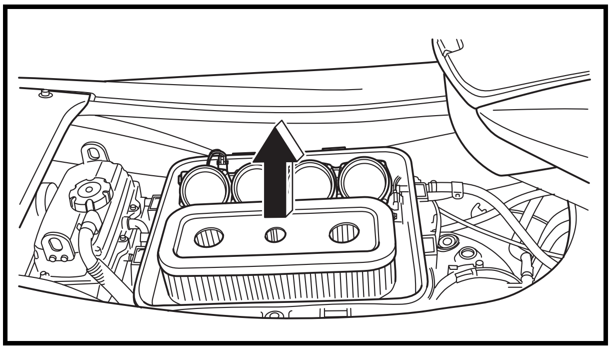
The following procedure applies to all of the cylinders.

**NOTE:**

Insufficient compression pressure will result in a loss of performance.



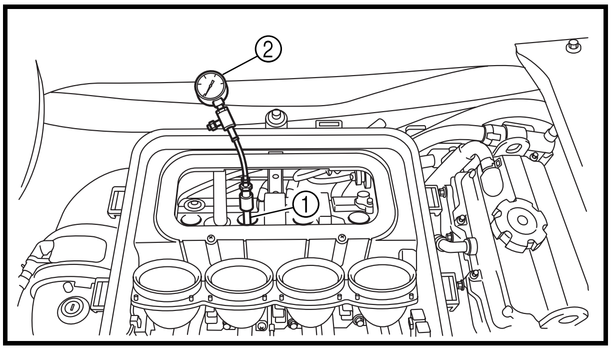

1. Measure:
   - Valve clearance
     Out of specification → Adjust.
     Refer to “POWER UNIT” in Chapter 3.
2. Warm the engine up, and then put the watercraft in a horizontal position.
3. Remove:
   - Air filter case cover ①
   - Air filter element



4. Disconnect:
   - Spark plug cap
5. Remove:
   - Spark plug

**CAUTION:**

**Before removing the spark plugs, use compressed air to blow away any dirt accumulated in the spark plug wells to prevent it from falling into the cylinders.**




6. Install:
   - Compression gauge extension ①
   - Compression gauge ②

**Compression gauge extension:**
**90890-06582**
**Compression gauge:**
**YU-33223-1/90890-03160**

7. Measure:
   - Compression pressure
     Out of specification → Refer to steps (b) and (c).

**Minimum compression pressure (reference data):**
**1,080 kPa**
**(10.8 kgf/cm$^2$, 157 psi)**

**Measurement steps:**

a. With the throttle wide open, crank the engine until the reading on the compression gauge stabilizes.

**WARNING**

**To prevent sparking, ground all spark plug leads before cranking the engine.**

**NOTE:**

The difference in compression pressure between cylinders should not exceed 100 kPa (1 kgf/cm$^2$, 14 psi).

b. If the compression pressure is extremely high, check the cylinder head, valve surfaces and piston crown for carbon deposits.
   Carbon deposits → Eliminate.

c. If the compression pressure is below the minimum specification, squirt a few drops of oil into the cylinder and measure again.

Refer to the following table.

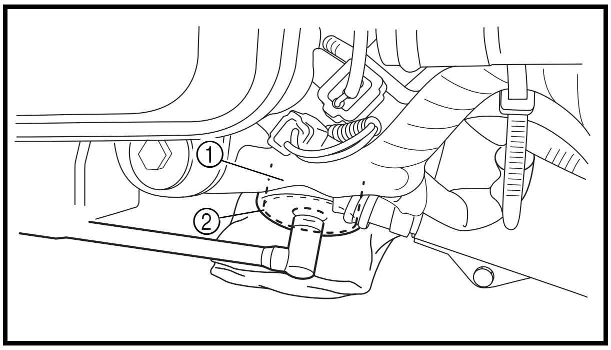
| **Compression pressure (with oil applied into the cylinder)** | |
|---|---|
| **Reading** | **Diagnosis** |
| **Higher than without oil** | **Piston wear or damage → Repair.** |
| **Same as without oil** | **Piston ring(s), valves, cylinder head gasket or piston possibly defective → Repair.** |

8. Install:
   - Spark plug

**Spark plug:**
**13 N • m (1.3 kgf • m, 9.4 ft • lb)**

9. Install:
   - Air filter element
   - Air filter case cover

| |
|---|
| **Air filter case cover screw:** <br> **2.5 N • m (0.25 kgf • m, 1.8 ft • lb)** <br> **LOCTITE® 572** |



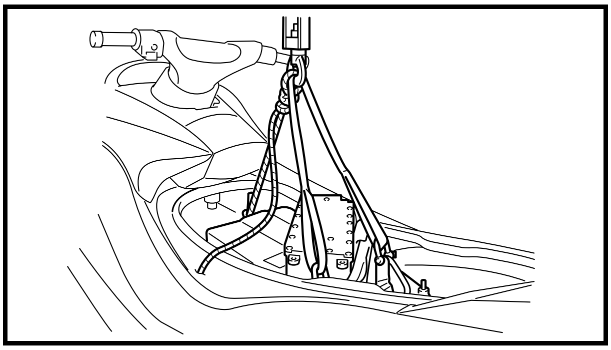

**Oil filter removal and installation**

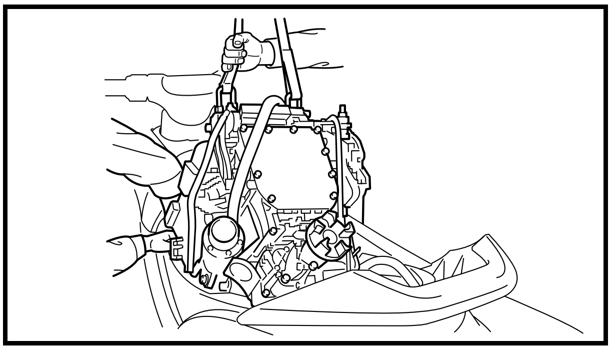
1. Remove:
   - Oil filter ①

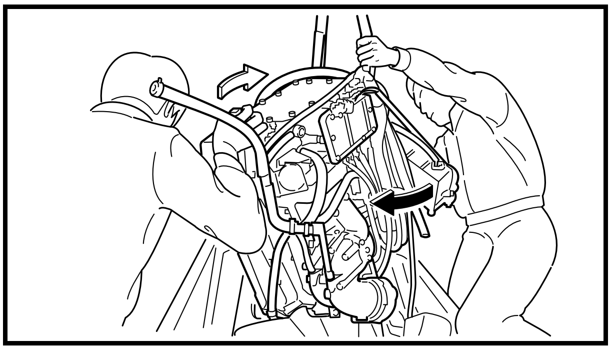
| |
|---|
| **Oil filter wrench ②:** <br> **YU-38411/90890-01426** |

| |
|---|
| **Oil filter:** <br> **17 N • m (1.7 kgf • m, 12 ft • lb)** |

**NOTE:**
Install the oil filter with the same special tool that was used for removal.







**Engine unit removal**

1. Remove:
   - Engine unit

**Removal steps:**

**CAUTION:**

**Lift the engine unit carefully trying not to hit it on the deck or letting it fall hard on the hull.**

- Suspend the engine unit using all three engine hangers, and then separate the unit from the engine mount.
- Remove the hoist cable from the front engine hanger and use the two rear engine hangers to suspend the engine unit.
- Lift the engine unit out vertically while turning it clockwise.

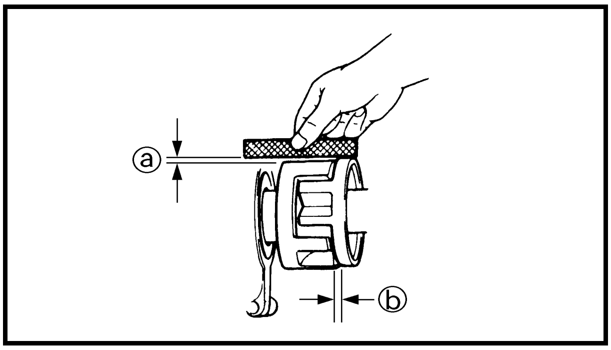
**Shim removal**

1. Remove:
   - Shims

**NOTE:**
To ease reassembly and coupling alignment, remove the shims and organize them in their respective groups (e.g., front right, rear left) prior to removing the mounting bolts.

**Engine mount inspection**

1. Inspect:
   - Engine mounts
     Cracks/damage → Replace.
     Refer to “ENGINE MOUNT” in Chapter 8.

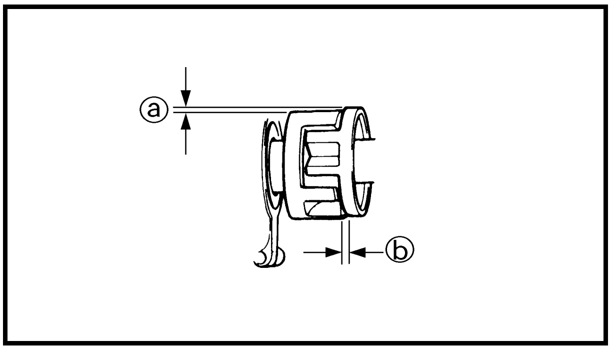



**Coupling clearance inspection**

1. Measure:
   - Clearance ⓐ
   - Clearance ⓑ
     (with the rubber damper)
     Out of specification → Adjust.

**NOTE:**
Measure the clearances with a straightedge and thickness gauge.

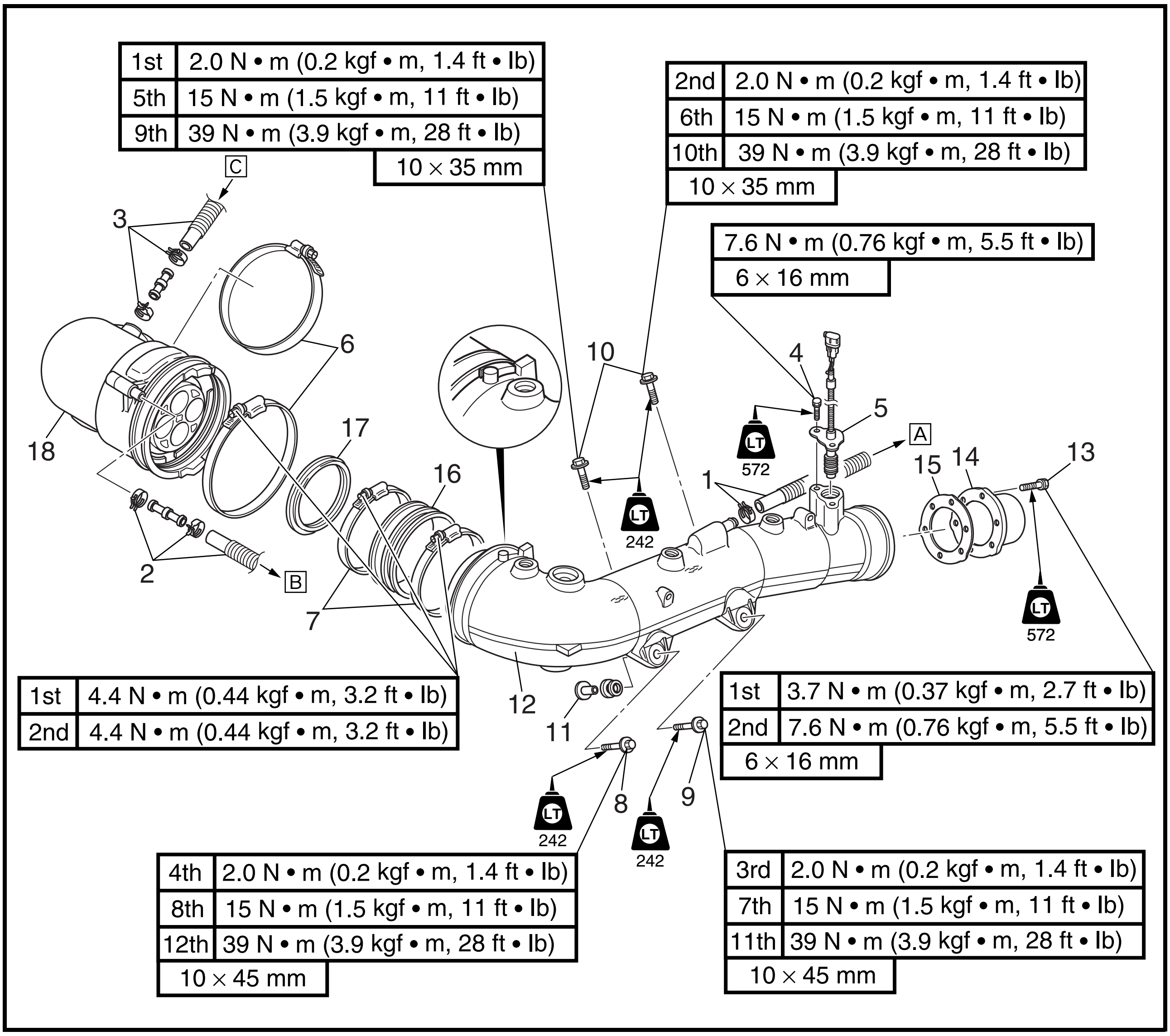
**Clearance ⓐ:**
**0–0.5 mm (0–0.020 in)**
**Clearance ⓑ:**
**2–4 mm (0.079–0.157 in)**




2. Adjust:
   - Clearance ⓐ and ⓑ

**Adjustment steps:**
- Adjust the clearance ⓐ by adding or removing shims.
- Adjust the clearance ⓑ by moving the engine unit position.

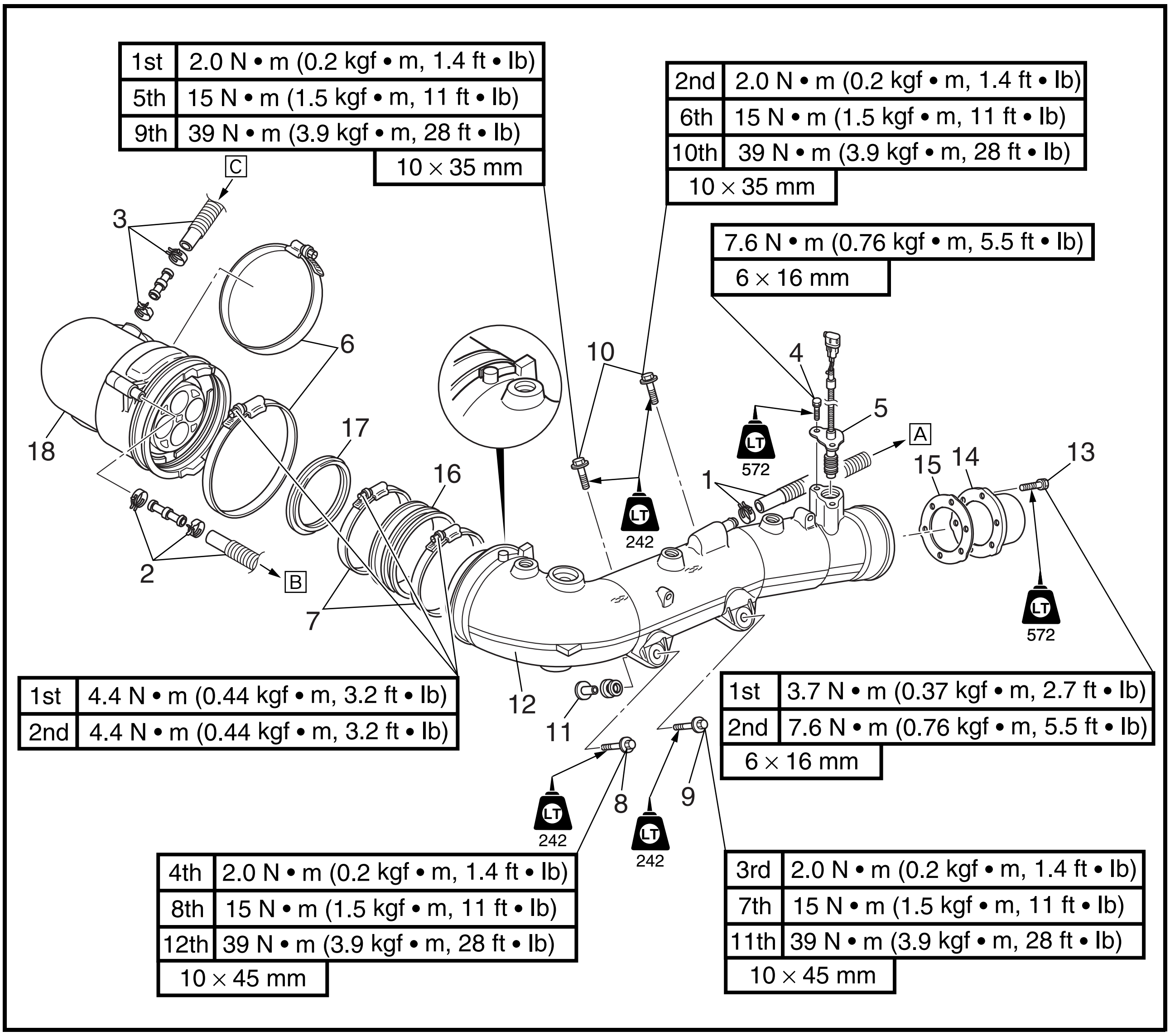
# EXHAUST PIPE 3
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

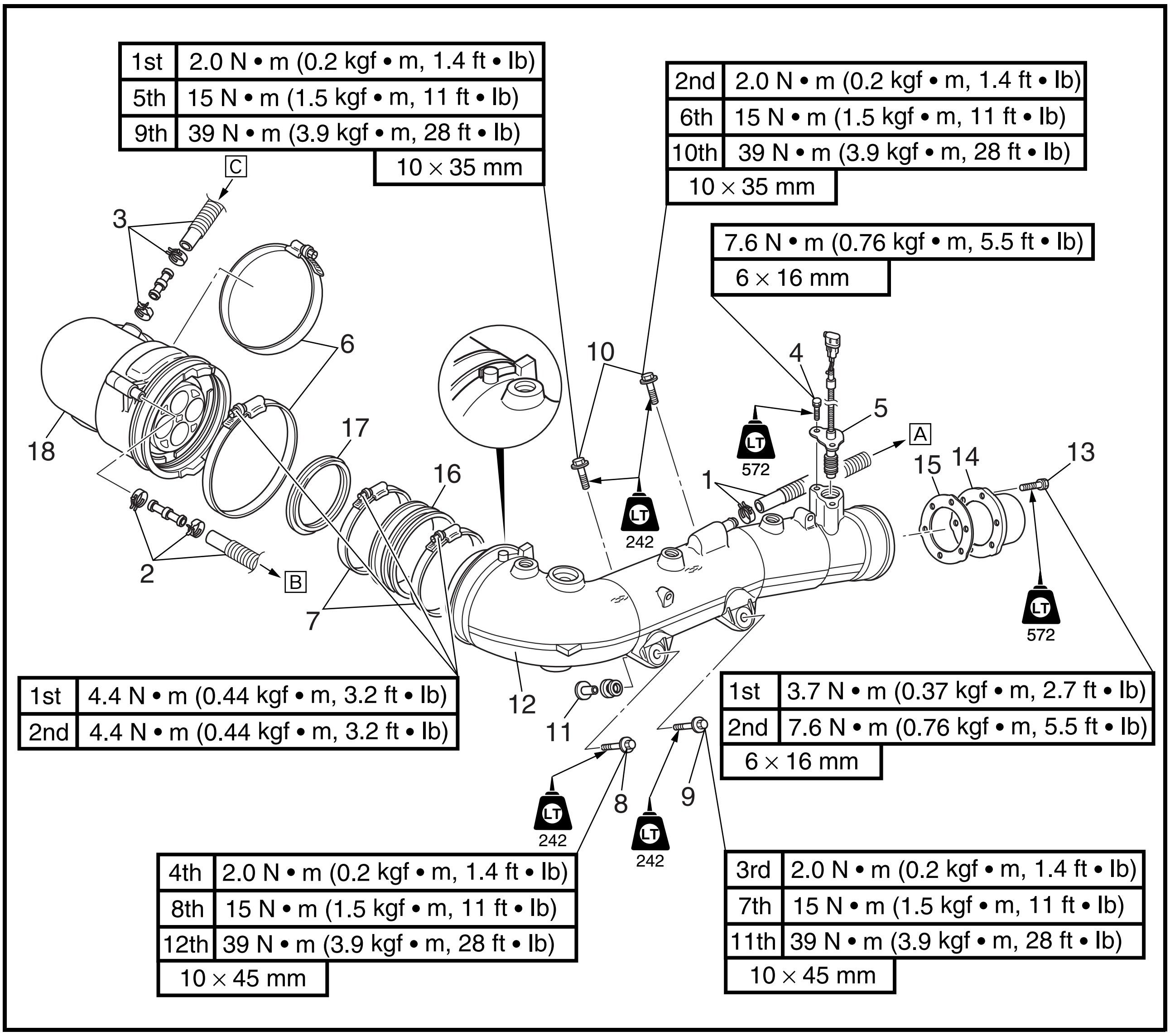
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **EXHAUST PIPE 3 REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT". |
| | Air filter case | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| 1 | Clamp/cooling water hose | 1/1 | A For cooling water outlet on stern side |
| 2 | Clamp/cooling water hose | 2/1 | B For cooling water pilot outlet on port side |
| 3 | Clamp/cooling water hose | 2/1 | C From water jacket |
| 4 | Bolt | 2 | |
| 5 | Thermoswitch (exhaust) | 1 | |

## EXPLODED DIAGRAM



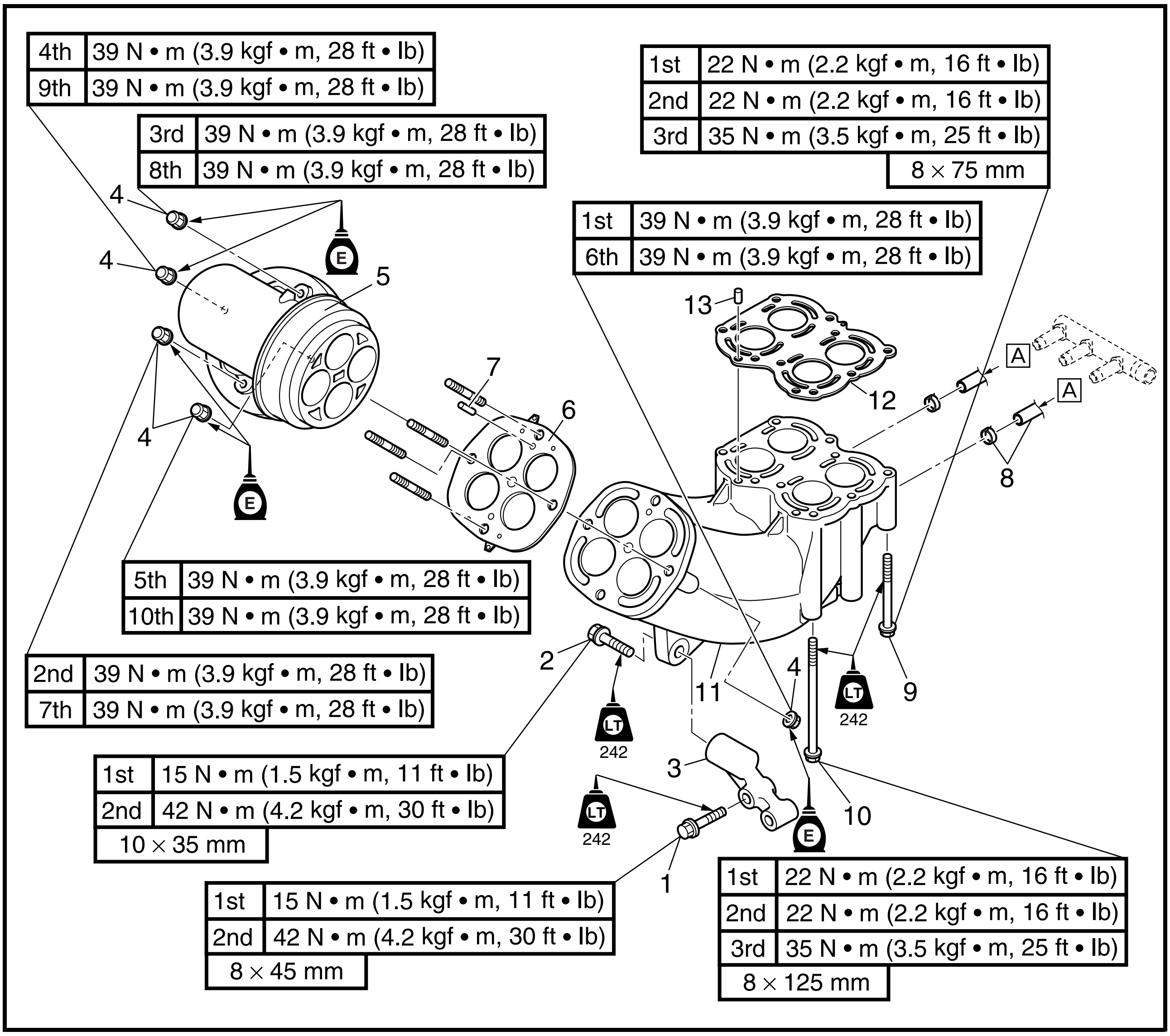

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Exhaust joint clamp | 2 | Slide the outer exhaust joint for exhaust manifold side |
| 7 | Exhaust joint clamp | 2 | |
| 8 | Bolt | 1 | |
| 9 | Bolt | 1 | |
| 10 | Bolt | 2 | |
| 11 | Collar | 1 | |
| 12 | Exhaust pipe 3 | 1 | |
| 13 | Bolt | 3 | |
| 14 | Exhaust pipe end | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 15 | Gasket | 1 | **Not reusable** |
| 16 | Inner exhaust joint | 1 | |
| 17 | Exhaust joint seal | 1 | |
| 18 | Outer exhaust joint | 1 | |
| | | | Reverse the removal steps for installation. |

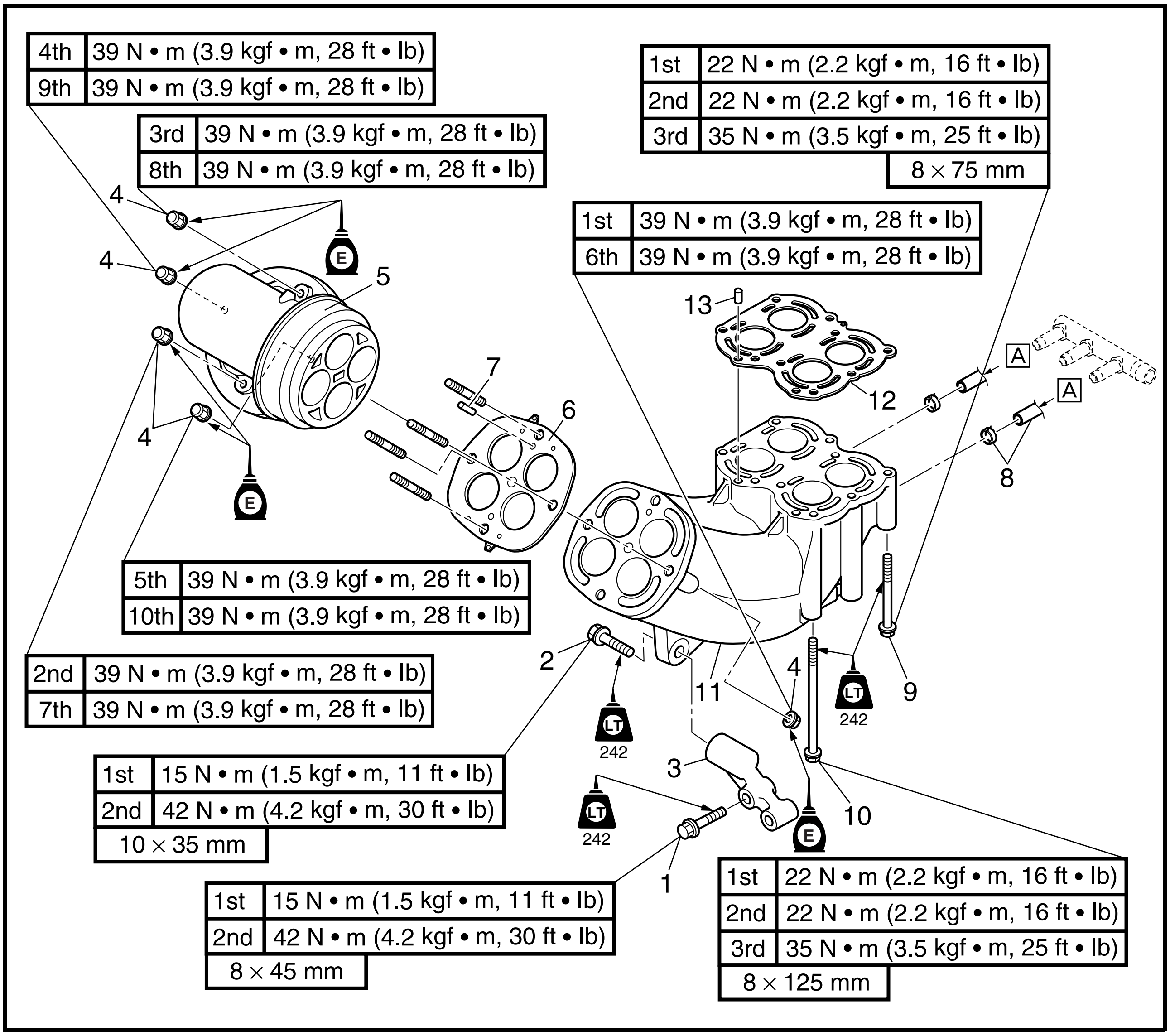
# EXHAUST PIPES 1 AND 2
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

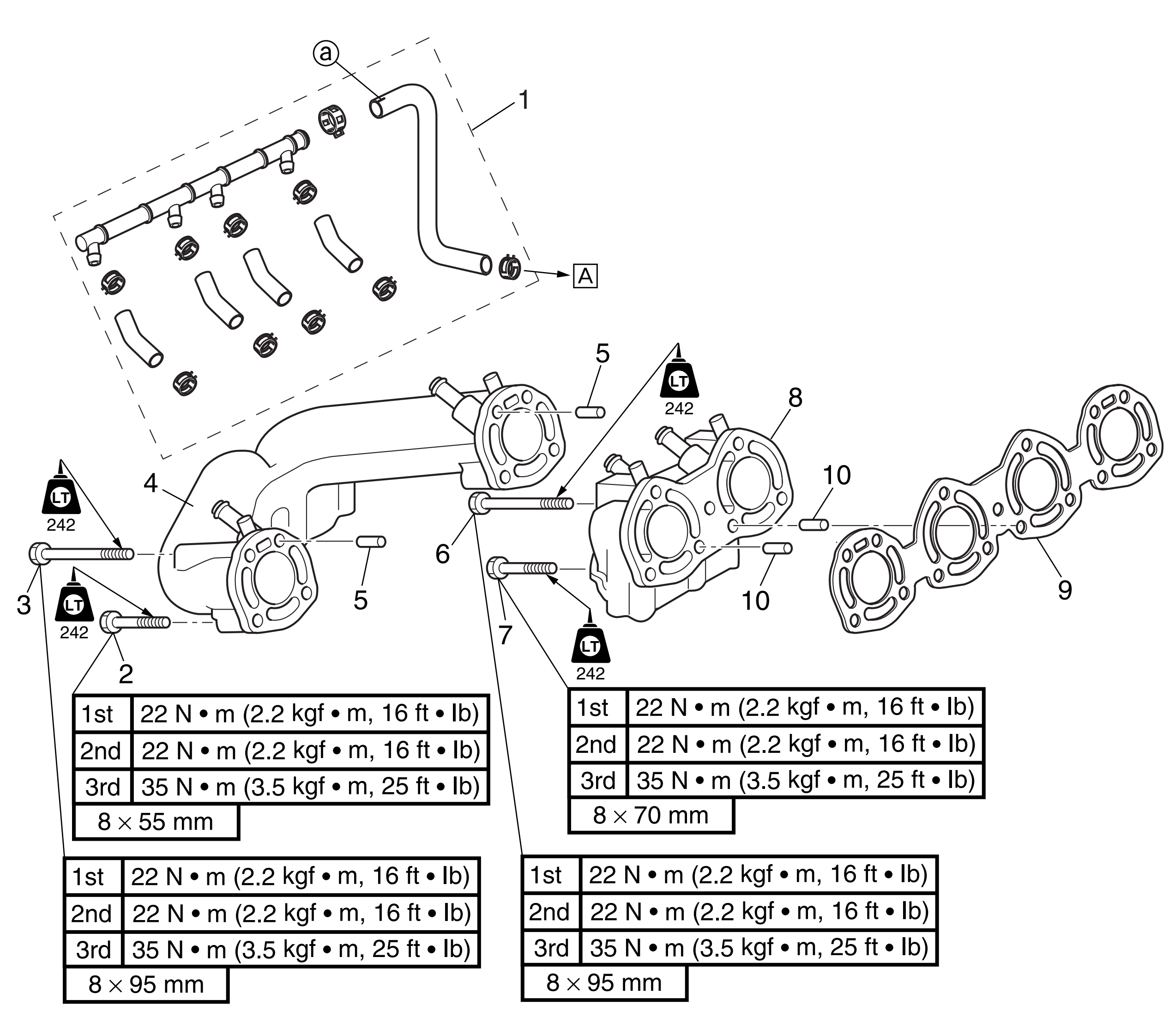
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **EXHAUST PIPES 1 AND 2 REMOVAL** | | Follow the left "Step" for removal. |
| | Exhaust pipe 3 | | Refer to "EXHAUST PIPE 3". |
| | Generator cover | | Refer to "GENERATOR AND STARTER MOTOR". |
| 1 | Bolt | 2 | |
| 2 | Bolt | 1 | |
| 3 | Exhaust pipe stay | 1 | |
| 4 | Nut | 5 | |
| 5 | Exhaust pipe 2 | 1 | |
| 6 | Gasket | 1 | **Not reusable** |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Dowel pin | 2 | |
| 8 | Clamp/cooling water hose | 2/2 | A From cooling water inlet |
| 9 | Bolt | 4 | |
| 10 | Bolt | 6 | |
| 11 | Exhaust pipe 1 | 1 | |
| 12 | Gasket | 1 | **Not reusable** |
| 13 | Dowel pin | 2 | |
| | | | Reverse the removal steps for installation. |

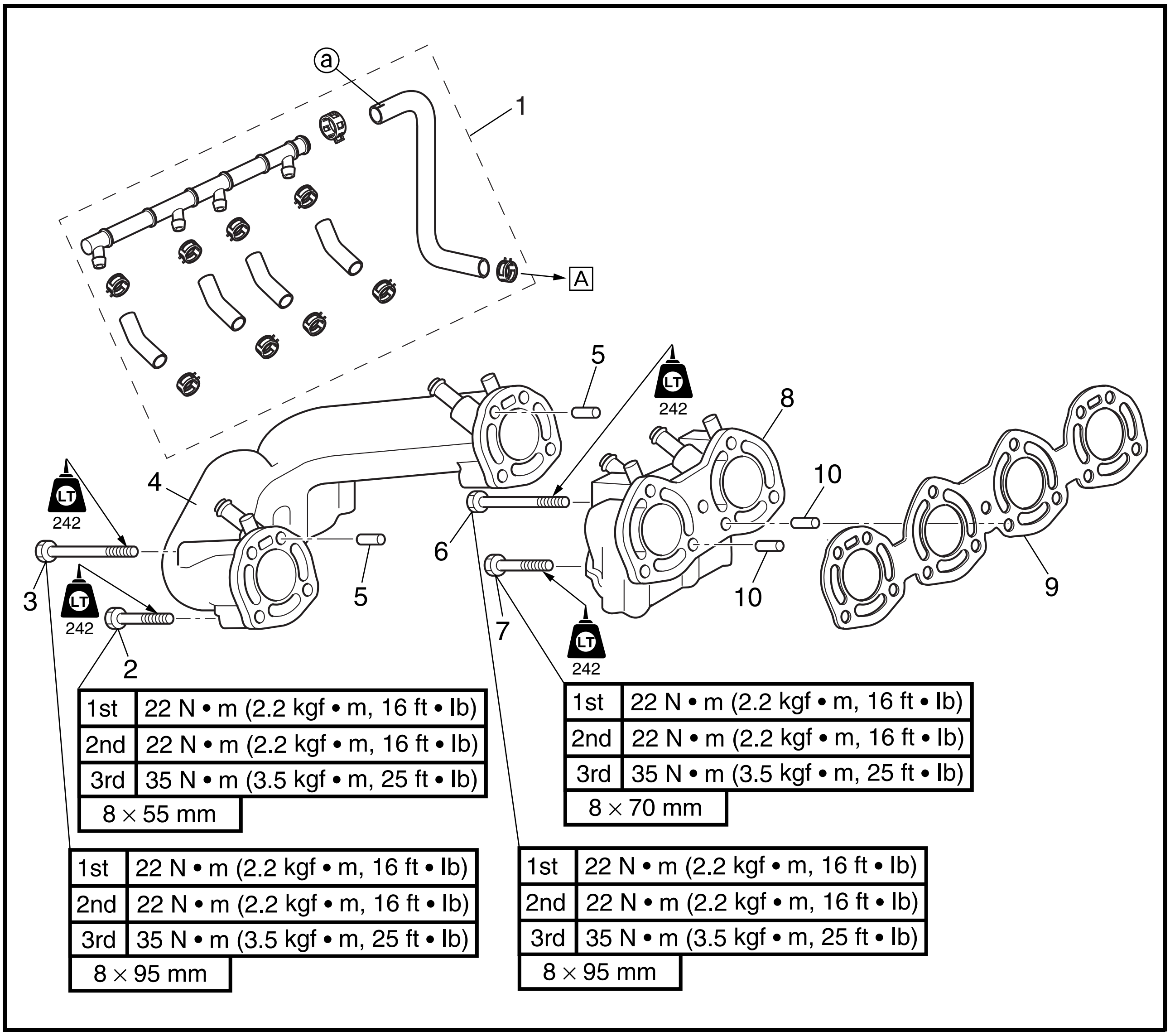
# EXHAUST MANIFOLD
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

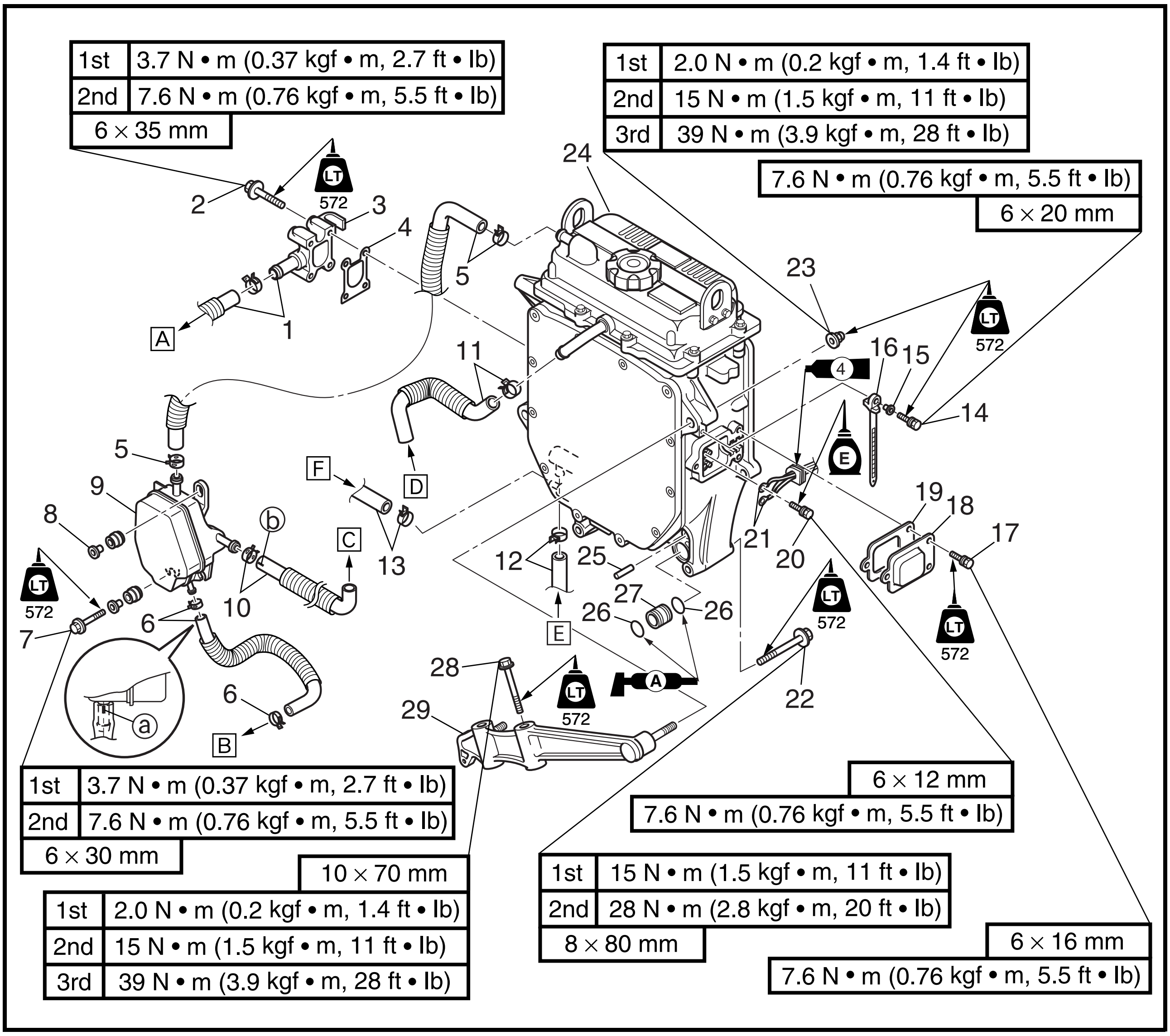
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **EXHAUST MANIFOLD REMOVAL** | | Follow the left "Step" for removal. |
| | Exhaust pipes 1 and 2 | | Refer to "EXHAUST PIPES 1 AND 2". |
| 1 | Joint assembly | 1 | A To pressure control valve<br>**NOTE:**<br>Install the cooling water hose with the white mark ⓐ facing up. |
| 2 | Bolt | 2 | |
| 3 | Bolt | 4 | |
| 4 | Exhaust manifold 1 | 1 | |
| 5 | Dowel pin | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Bolt | 1 | |
| 7 | Bolt | 4 | |
| 8 | Exhaust manifold 2 | 1 | |
| 9 | Gasket | 1 | **Not reusable** |
| 10 | Dowel pin | 2 | |
| | | | Reverse the removal steps for installation. |

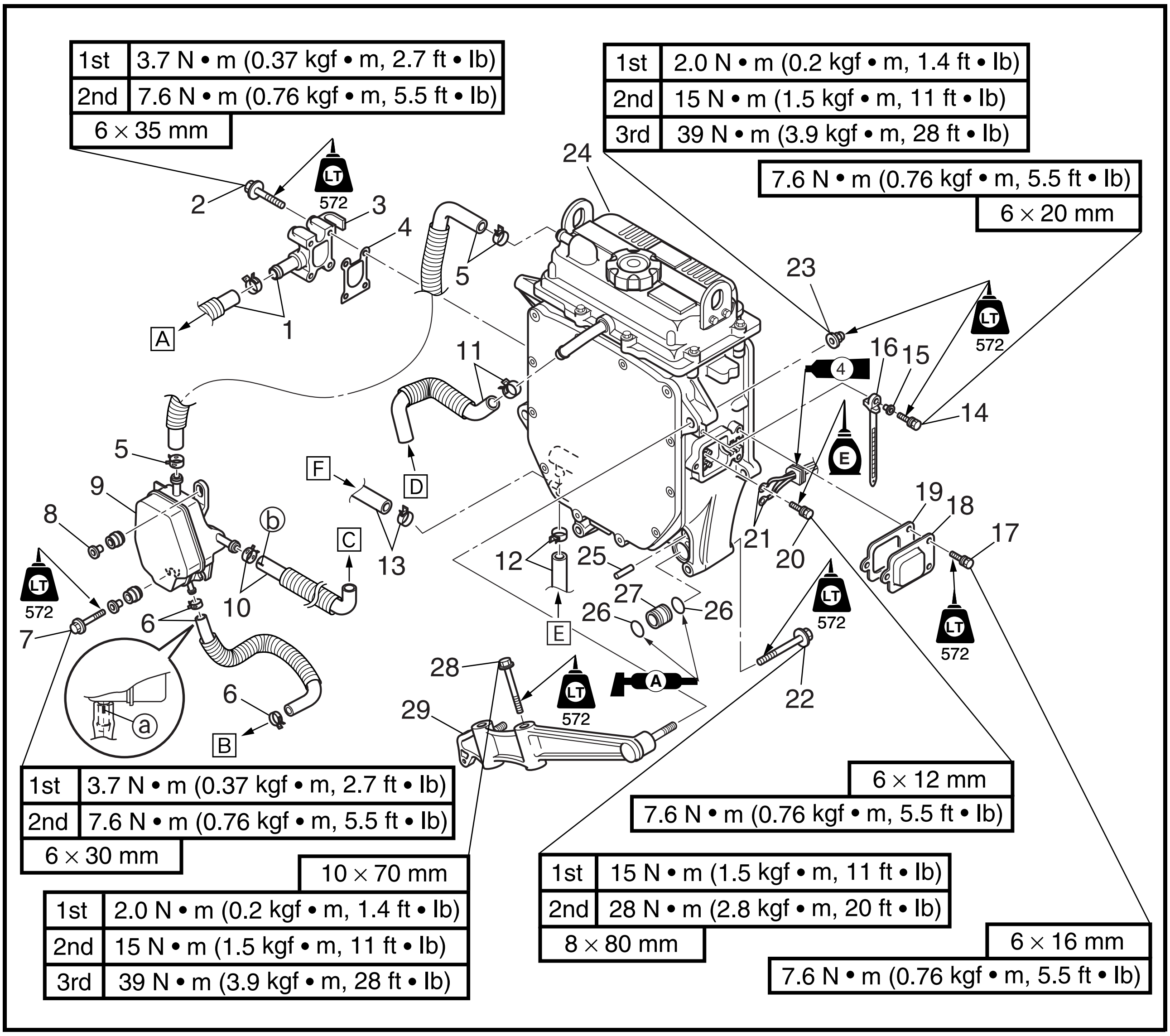
# OIL TANK
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

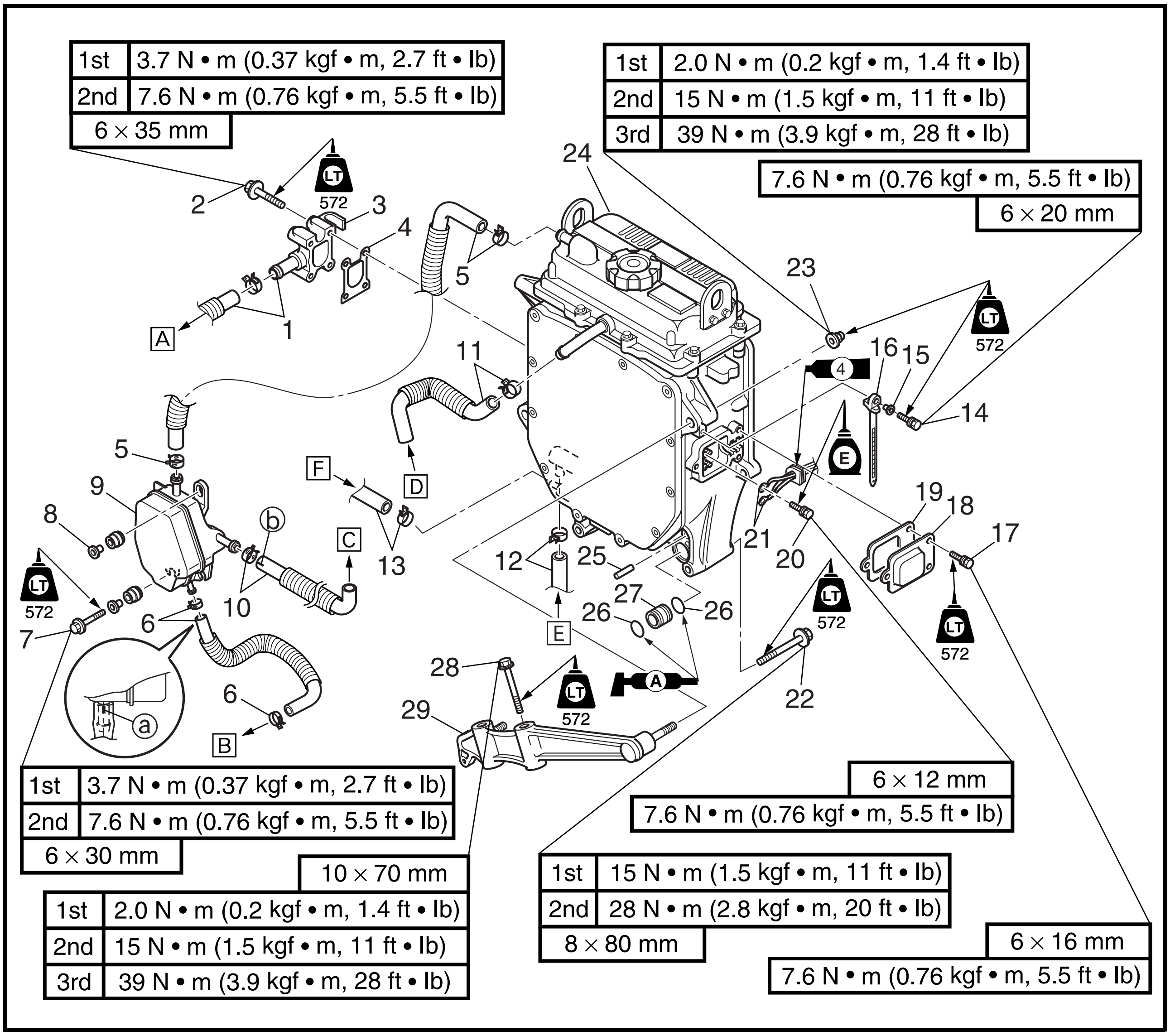
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL TANK REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT". |
| | Air filter case | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| | Ignition coil box | | Refer to "ELECTRICAL BOX AND IGNITION COIL BOX" in Chapter 7. |
| | Thermostat housing | | Refer to "THERMOSTAT". |
| 1 | Clamp/cooling water hose | 1/1 | A To exhaust joint |
| 2 | Bolt | 4 | |
| 3 | Water jacket | 1 | |
| 4 | Gasket | 1 | **Not reusable** |

## EXPLODED DIAGRAM



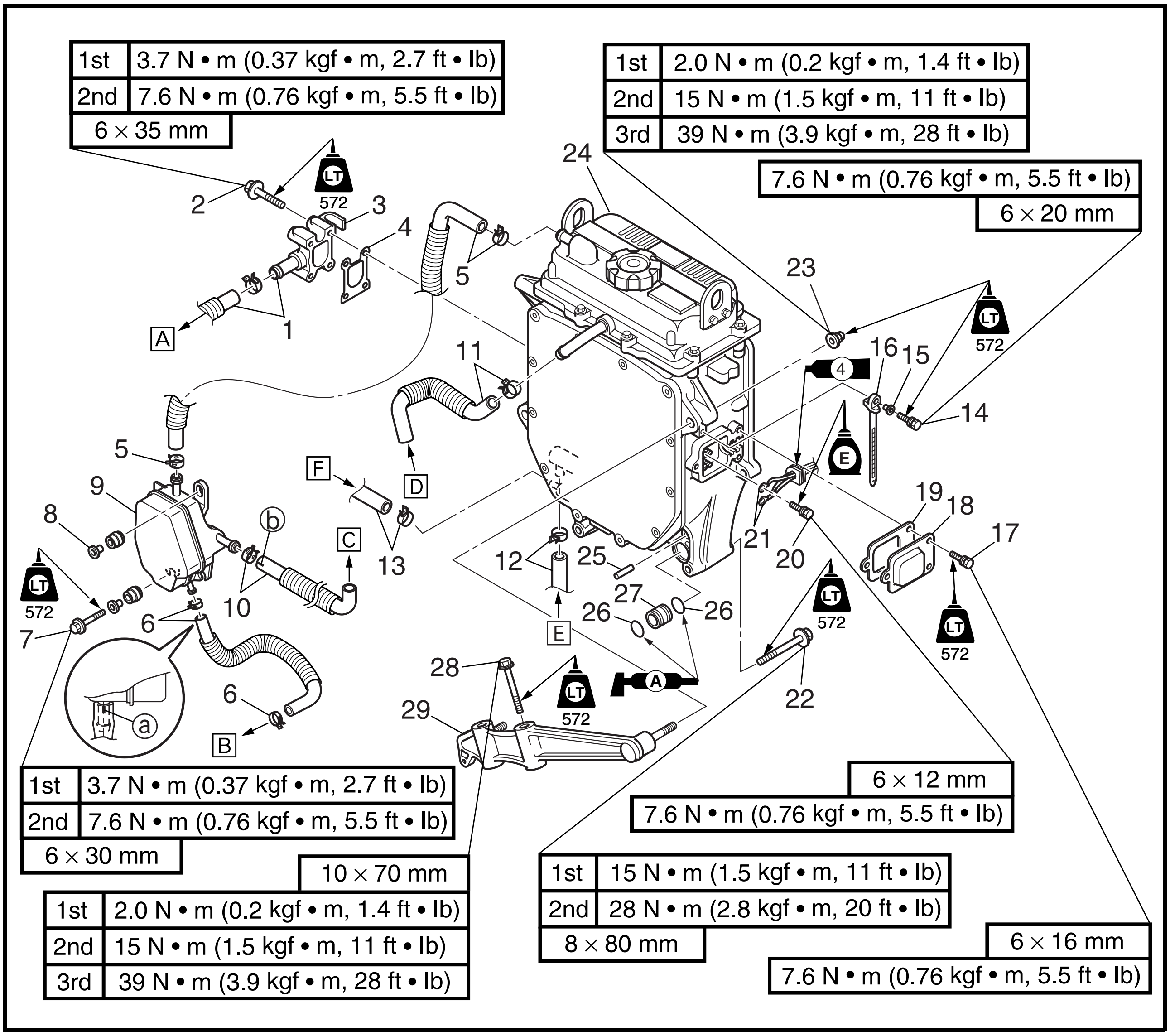

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 5 | Clamp/breather hose | 2/1 | |
| 6 | Clamp/breather hose | 2/1 | B To oil pump<br>Align the mark ⓐ of the breather hose with the parting line of the oil separator. |
| 7 | Bolt | 3 | |
| 8 | Collar | 2 | |
| 9 | Oil separator | 1 | |
| 10 | Clamp/breather hose | 1/1 | C To air filter case<br>Mark ⓑ |
| 11 | Clamp/breather hose | 1/1 | D From cylinder head cover |

## EXPLODED DIAGRAM



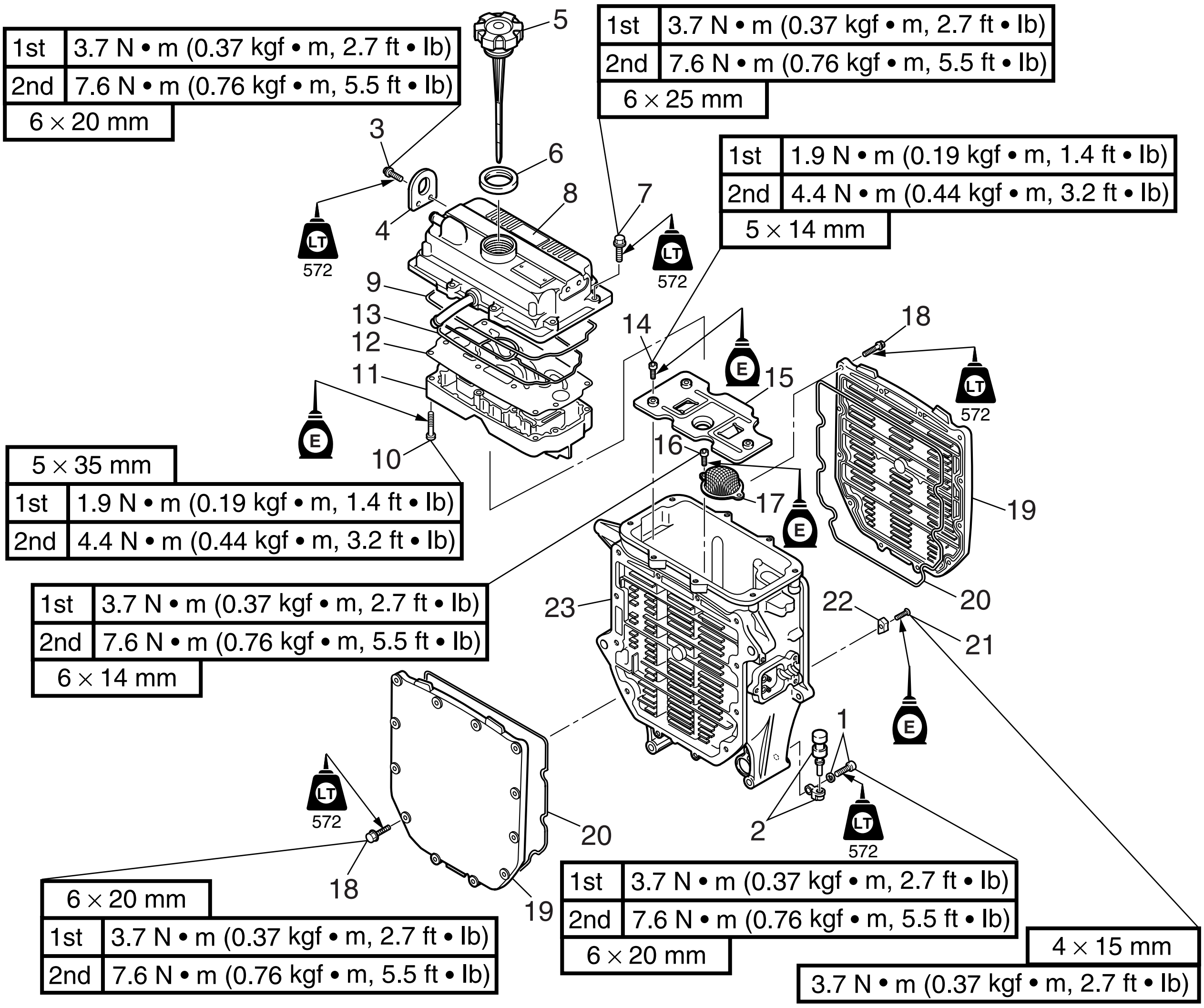

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 12 | Clamp/cooling water hose | 1/1 | E From cooling water inlet |
| 13 | Clamp/cooling water hose | 1/1 | F From pressure control valve |
| 14 | Bolt | 1 | |
| 15 | Collar | 1 | |
| 16 | Band | 1 | |
| 17 | Bolt | 3 | |
| 18 | Cover | 1 | |
| 19 | Gasket | 1 | **Not reusable** |
| 20 | Bolt | 2 | |
| 21 | Ground lead | 2 | |
| 22 | Bolt | 4 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 23 | Nut | 2 | |
| 24 | Oil tank | 1 | |
| 25 | Pin | 2 | |
| 26 | O-ring | 4 | **Not reusable** |
| 27 | Connector | 2 | |
| 28 | Bolt | 2 | |
| 29 | Oil tank stay | 1 | |
| | | | Reverse the removal steps for installation. |

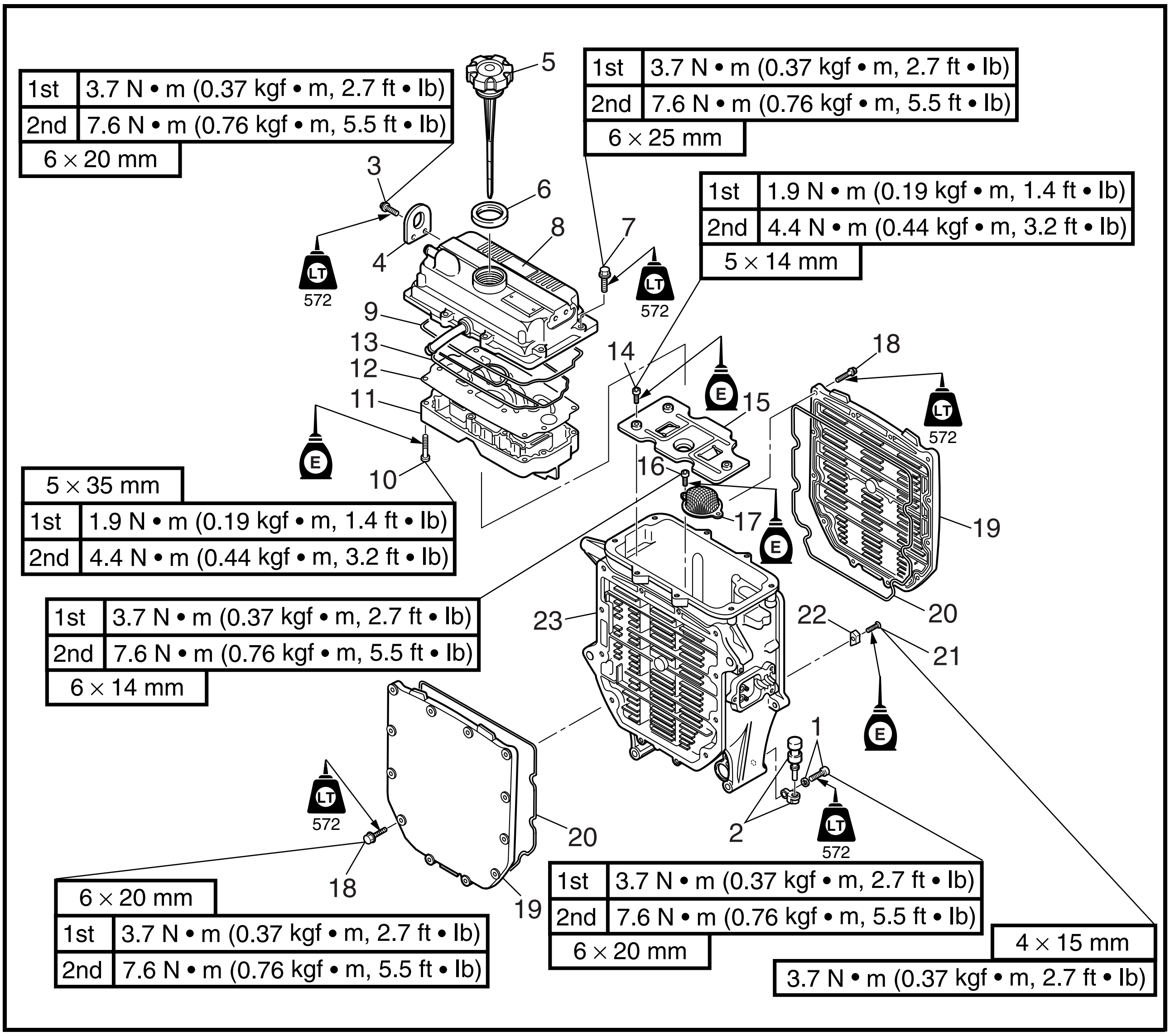
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

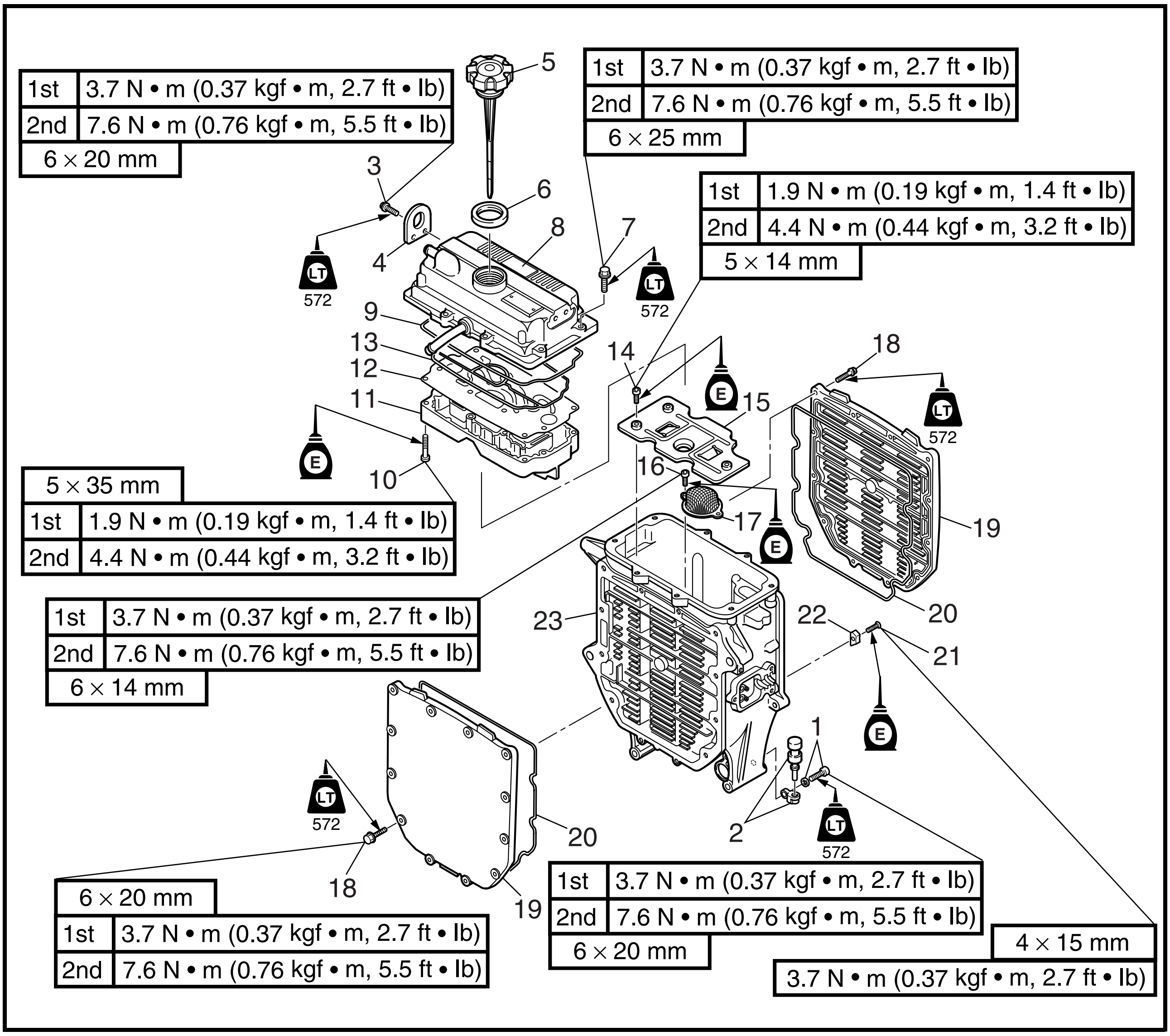
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL TANK DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt/washer | 2/2 | |
| 2 | Bracket/grommet | 2/2 | |
| 3 | Bolt | 4 | |
| 4 | Hunger | 2 | |
| 5 | Oil filter cap | 1 | |
| 6 | Packing | 1 | |
| 7 | Bolt | 8 | |
| 8 | Oil tank cover | 1 | |
| 9 | Gasket | 1 | **Not reusable** |
| 10 | Bolt | 10 | |

## EXPLODED DIAGRAM

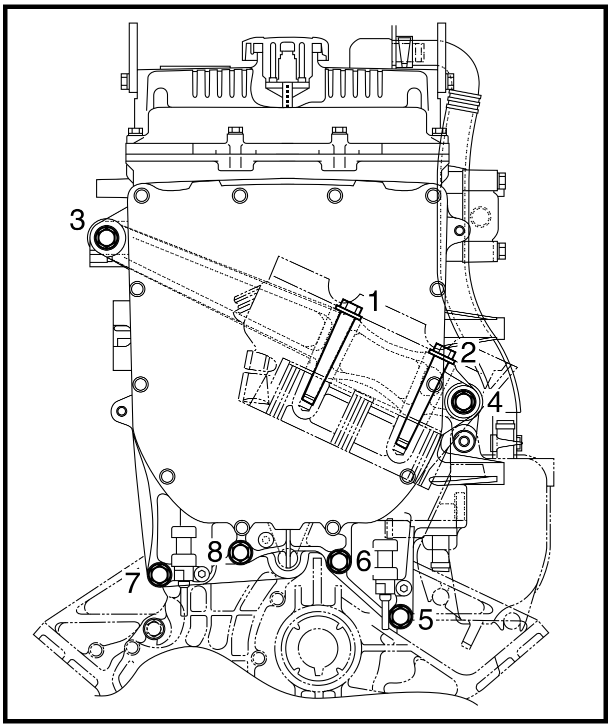



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 11 | Oil breather plate 1 | 1 | |
| 12 | Oil breather plate 2 | 1 | |
| 13 | Gasket | 1 | **Not reusable** |
| 14 | Bolt | 3 | |
| 15 | Baffle plate | 1 | |
| 16 | Bolt | 2 | |
| 17 | Oil strainer | 1 | |
| 18 | Bolt | 24 | |
| 19 | Oil cooler cover | 2 | |
| 20 | Gasket | 2 | **Not reusable** |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 21 | Screw | 1 | |
| 22 | Anode | 1 | |
| 23 | Oil tank | 1 | |
| | | | Reverse the disassembly steps for assembly. |

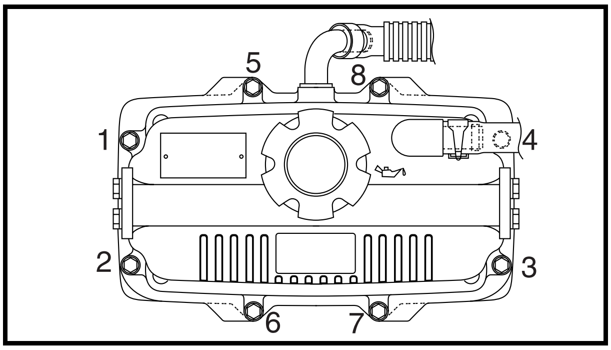



## SERVICE POINTS

### Oil tank removal

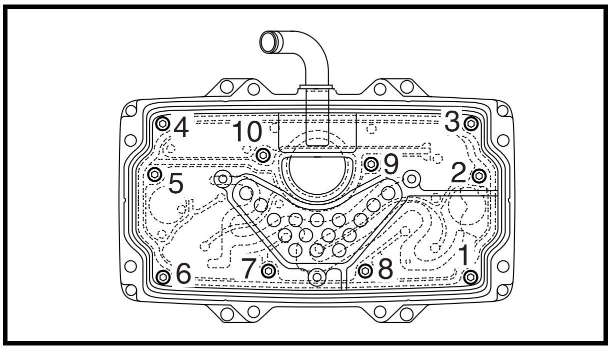
1. Remove:
   - Oil tank

**NOTE:**
Loosen the oil tank bolts and nuts in the sequence shown.



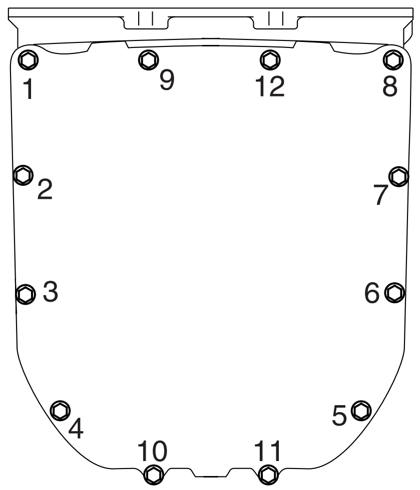

2. Remove:
   - Oil tank cover
   - Gasket

**NOTE:**
Loosen the oil tank cover bolts in the sequence shown.



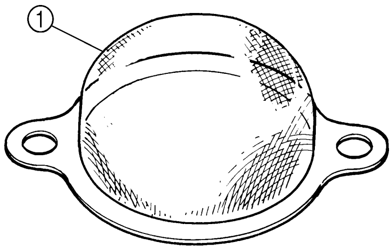

3. Remove:
   - Oil breather plate 1
   - Oil breather plate 2
   - Gasket

**NOTE:**
Loosen the oil breather plate bolts in the sequence shown.



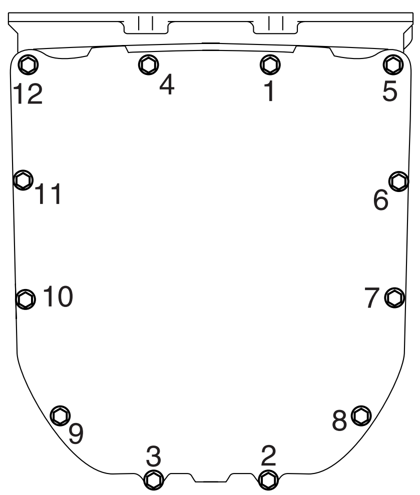

4. Remove:
   - Oil cooler covers
   - Gaskets

**NOTE:**
Loosen the oil cooler cover bolts in the sequence shown.




**Oil strainer inspection**

1. Check:
   - Oil strainer ①
     Damage → Replace.
     Contaminants → Clean with engine oil.

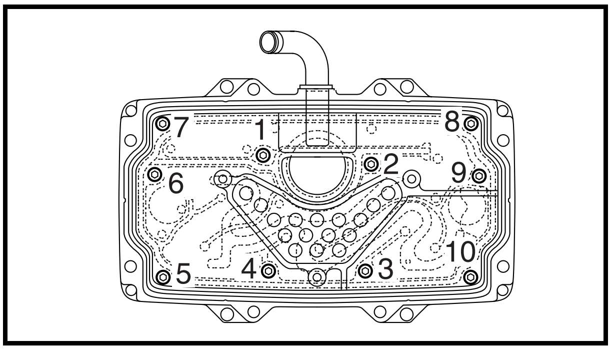



**Oil tank installation**

1. Install:
   - Oil cooler covers
   - Gaskets

**NOTE:**
Tighten the oil cooler bolts in the sequence shown.

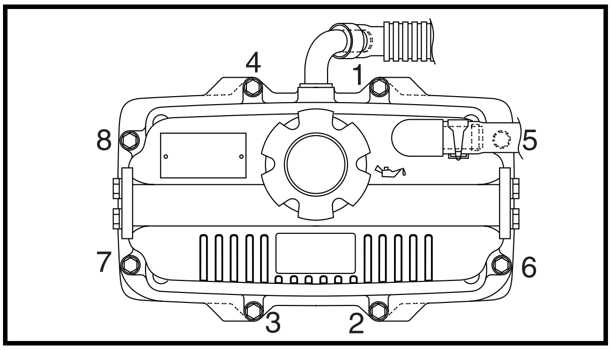
**Oil cooler cover bolt:**
**1st:**
**3.7 N • m**
**(0.37 kgf • m, 2.7 ft • lb)**
**2nd:**
**7.6 N • m**
**(0.76 kgf • m, 5.5 ft • lb)**




2. Install:
   - Gasket
   - Oil breather plate 2
   - Oil breather plate 1

**NOTE:**
Tighten the oil breather plate bolts in the sequence shown.

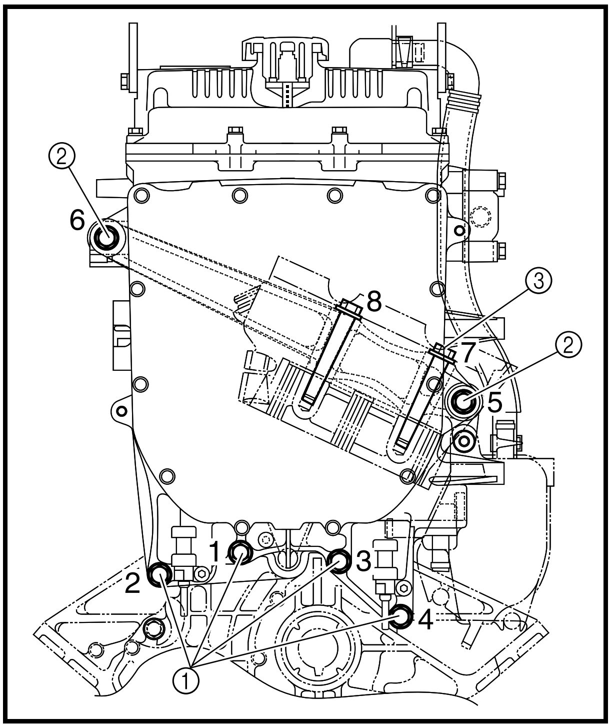
**Oil breather plate bolt:**
**1st:**
**1.9 N • m**
**(0.19 kgf • m, 1.4 ft • lb)**
**2nd:**
**4.4 N • m**
**(0.44 kgf • m, 3.2 ft • lb)**




3. Install:
   - Gasket
   - Oil tank cover

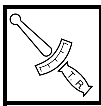
**NOTE:**
Tighten the oil tank cover bolts in the sequence shown.

**Oil tank cover bolt:**
**1st:**
**3.7 N • m**
**(0.37 kgf • m, 2.7 ft • lb)**
**2nd:**
**7.6 N • m**
**(0.76 kgf • m, 5.5 ft • lb)**



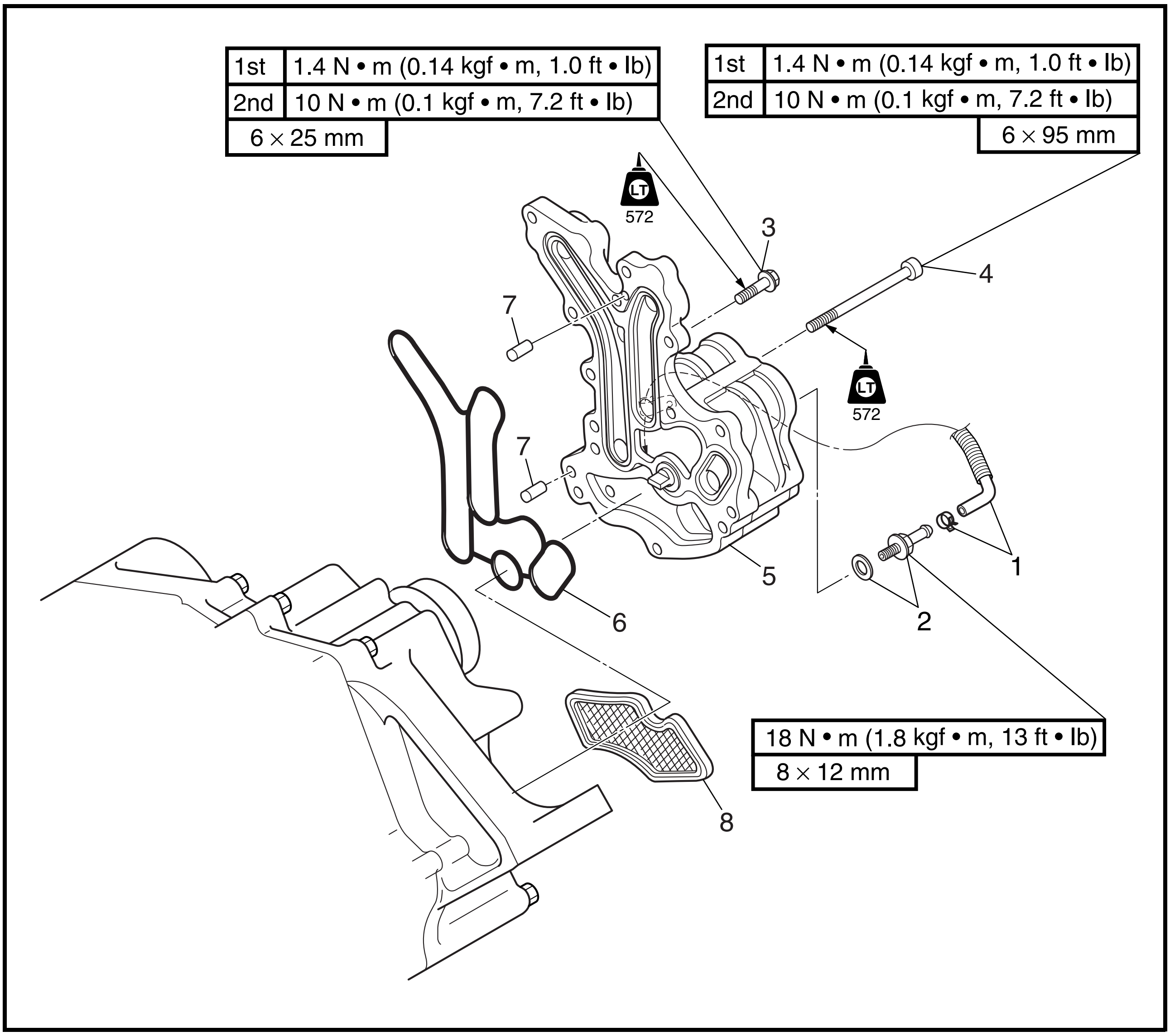

4. Install:
   - Oil tank

**NOTE:**
Tighten the oil tank nuts and bolts in the sequence shown.



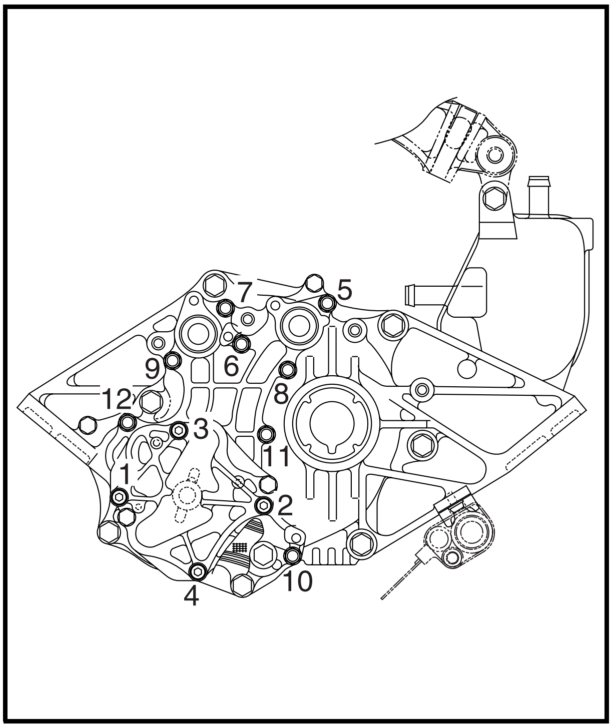
**Bolt ①:**
**1st:**
**15 N • m (1.5 kgf • m, 11 ft • lb)**
**2nd:**
**28 N • m (2.8 kgf • m, 20 ft • lb)**
**Nut ②, bolt ③:**
**1st:**
**2.0 N • m**
**(0.20 kgf • m, 1.4 ft • lb)**
**2nd:**
**15 N • m (1.5 kgf • m, 11 ft • lb)**
**3rd:**
**39 N • m (3.9 kgf • m, 28 ft • lb)**

# OIL PUMP
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL PUMP ASSEMBLY REMOVAL** | | Follow the left "Step" for removal. |
| | Oil tank | | Refer to "OIL TANK". |
| 1 | Clamp/breather hose | 1/1 | |
| 2 | Drain plug/washer | 1/1 | Drain engine oil. |
| 3 | Bolt | 8 | |
| 4 | Bolt | 4 | |
| 5 | Oil pump assembly | 1 | |
| 6 | Gasket | 1 | **Not reusable** |
| 7 | Pin | 2 | |
| 8 | Strainer | 1 | |
| | | | Reverse the removal steps for installation. |

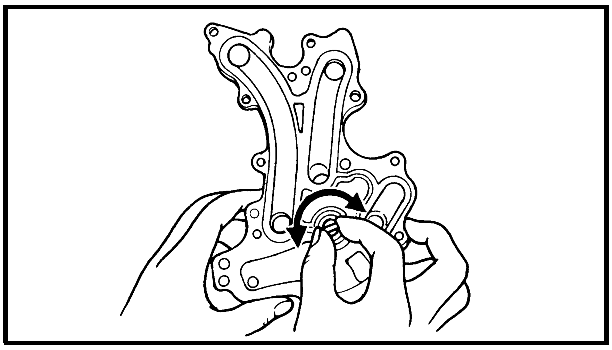



## SERVICE POINTS

**Oil pump removal**

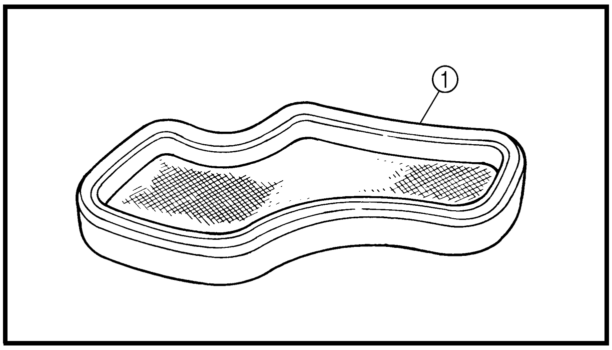
1. Remove:
   - Oil pump assembly

**NOTE:**
Loosen the oil pump bolts in the sequence shown.



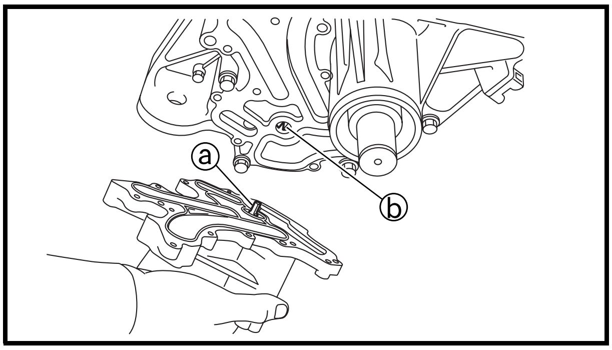
**Oil pump inspection**

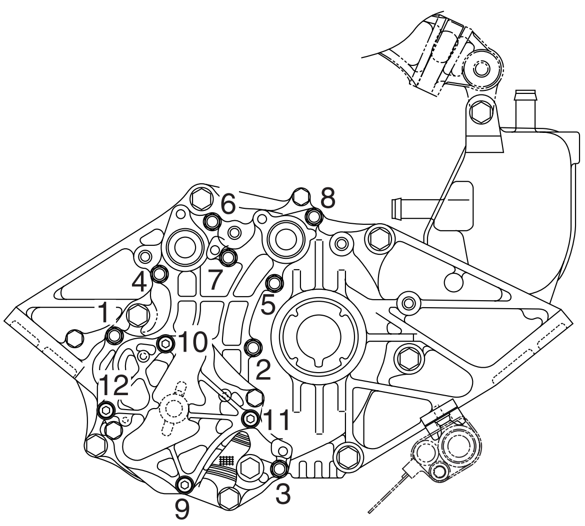
1. Check:
   - Oil pump operation
     Rough movement → Replace the defective part(s).




**Oil strainer inspection**

1. Check:
   - Oil strainer ①
     Damage → Replace.
     Contaminants → Clean with engine oil.




**Oil pump installation**

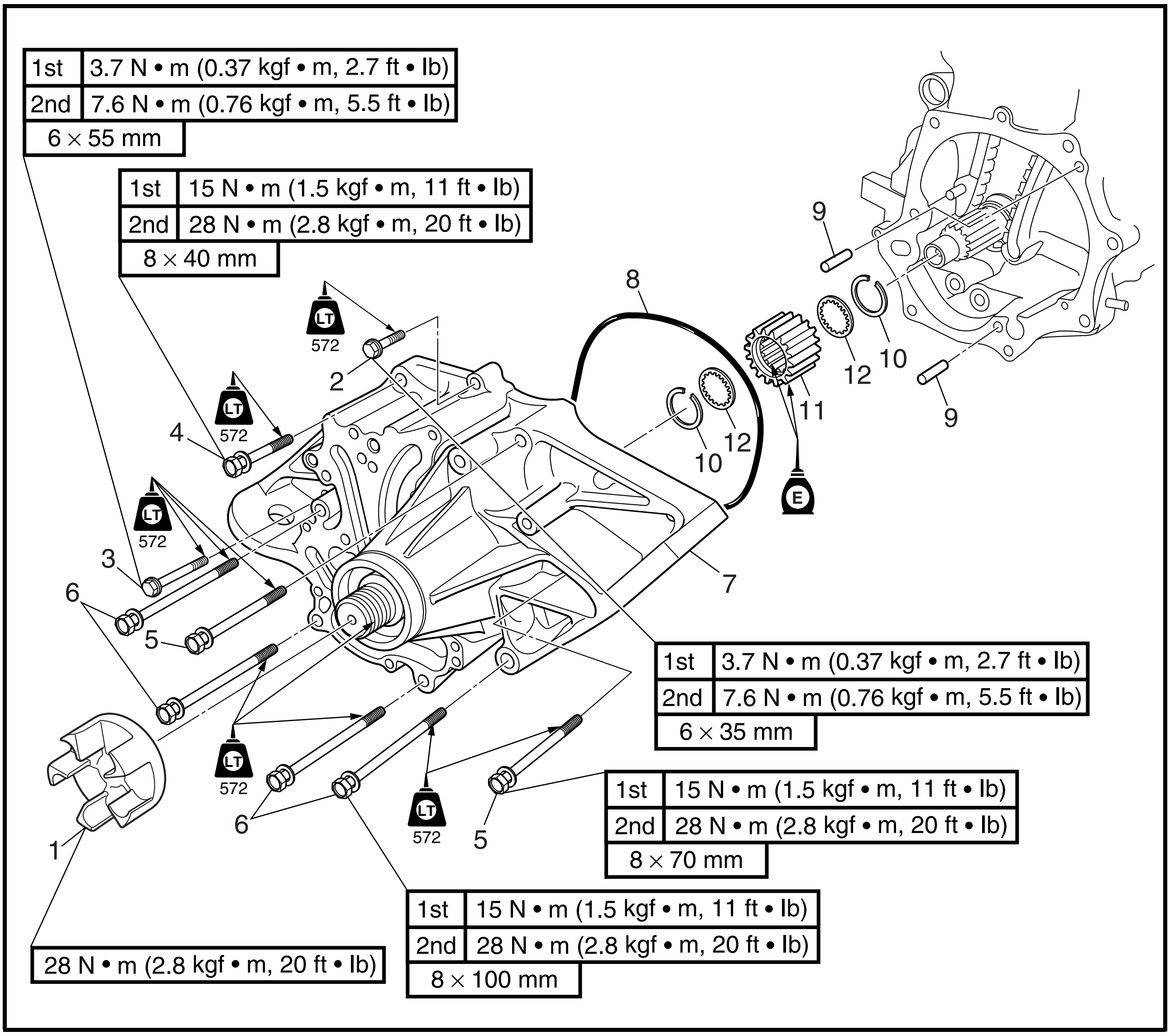
1. Install:
   - Oil pump assembly

**NOTE:**

- Align the projection ⓐ on the oil pump assembly with the slit ⓑ on the oil pump driven gear shaft.
- Tighten the oil pump bolts in the sequence shown.

**Oil pump assembly bolt:**
**1st:**
**1.4 N • m**
**(0.14 kgf • m, 1.0 ft • lb)**
**2nd:**
**10 N • m (1.0 kgf • m, 7.2 ft • lb)**

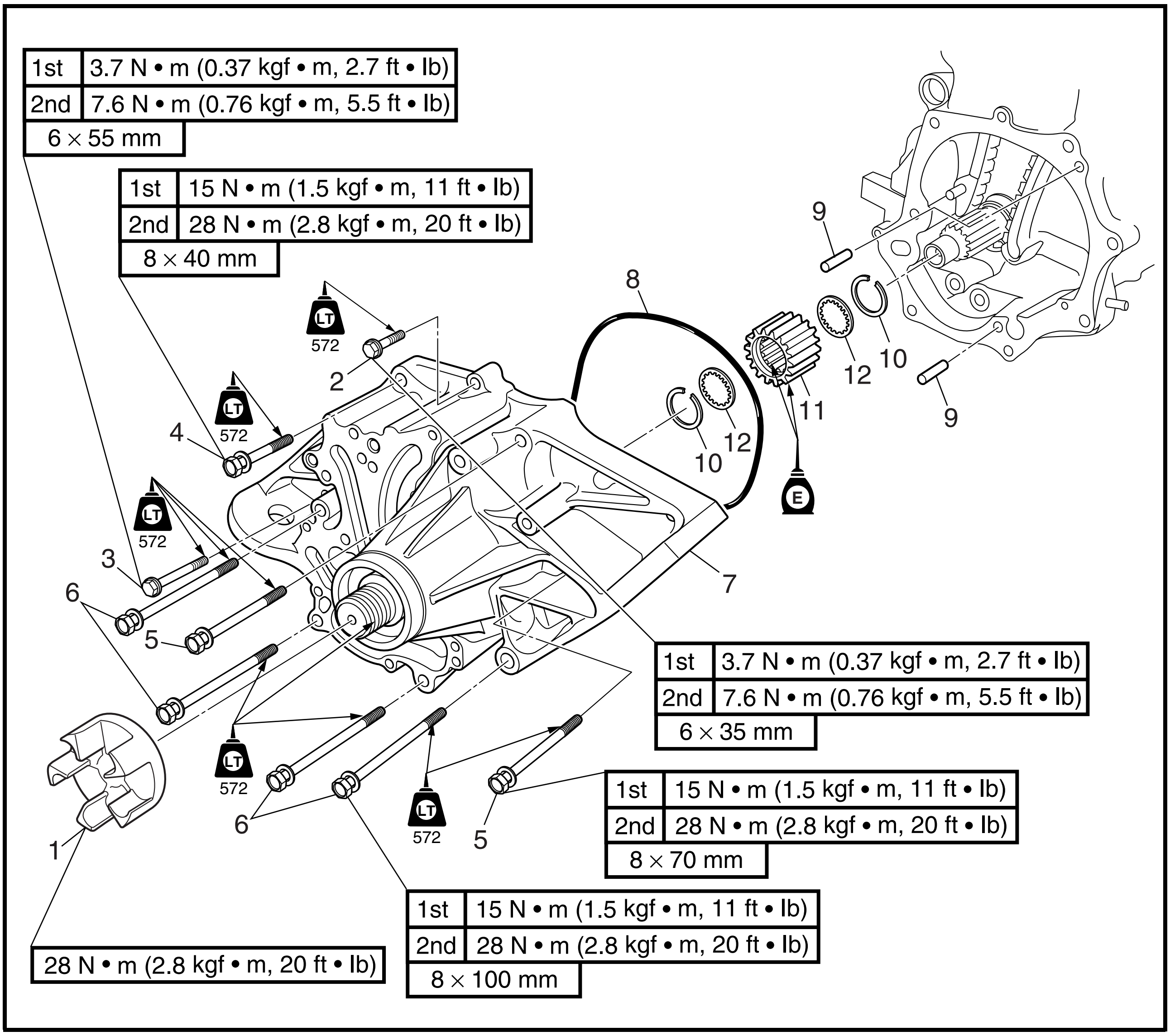
# REDUCTION DRIVE GEAR
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

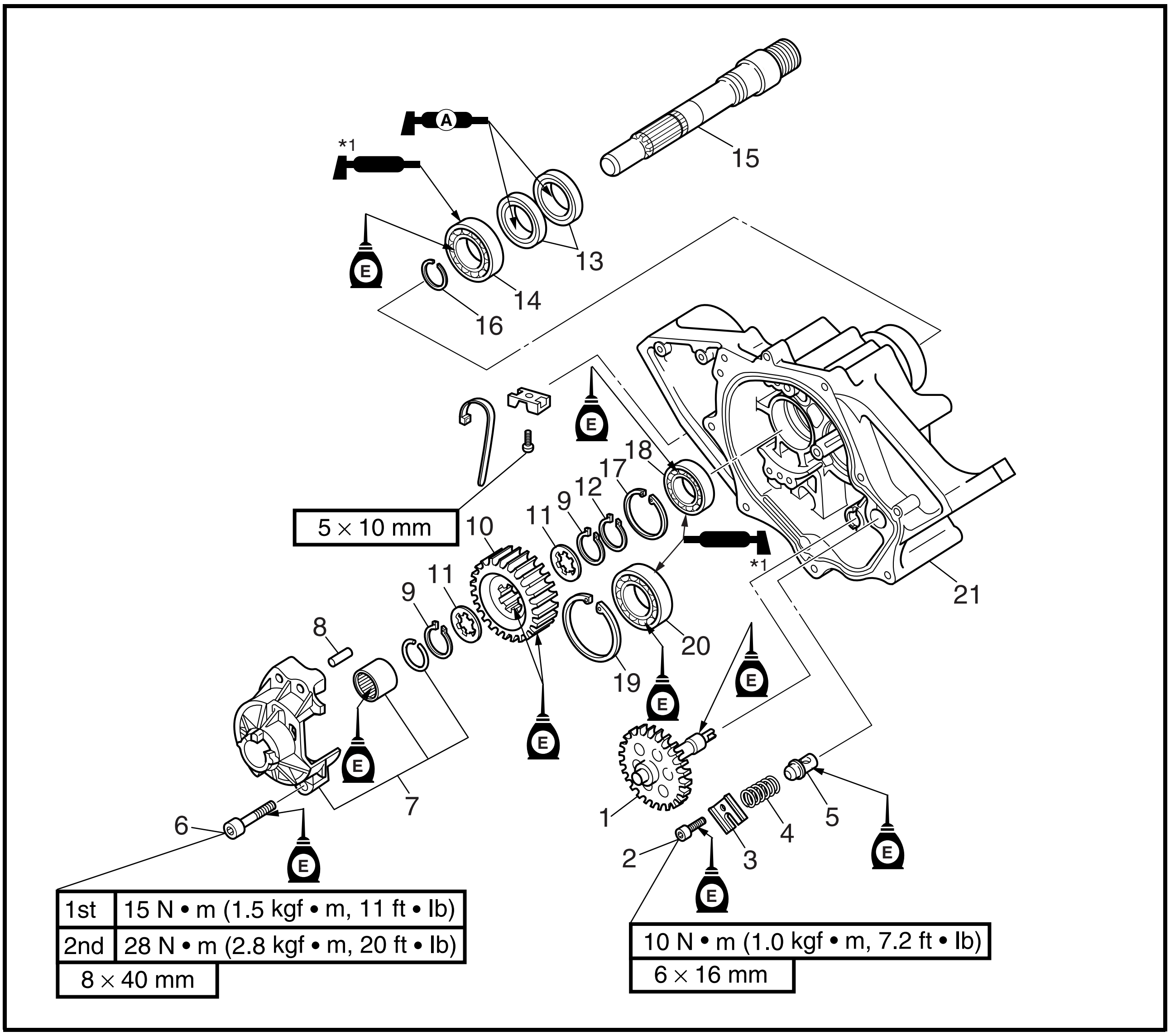
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **REDUCTION DRIVE GEAR REMOVAL** | | Follow the left "Step" for removal. |
| | Generator cover | | Refer to "GENERATOR AND STARTER MOTOR". |
| | Oil pump | | Refer to "OIL PUMP". |
| 1 | Drive coupling | 1 | |
| 2 | Bolt | 1 | |
| 3 | Bolt | 1 | |
| 4 | Bolt | 1 | |
| 5 | Bolt | 2 | |
| 6 | Bolt | 4 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Reduction drive gear case | 1 | |
| 8 | Gasket | 1 | Not reusable |
| 9 | Pin | 2 | |
| 10 | Circlip | 2 | Not reusable |
| 11 | Reduction drive gear | 1 | |
| 12 | Washer | 2 | |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM

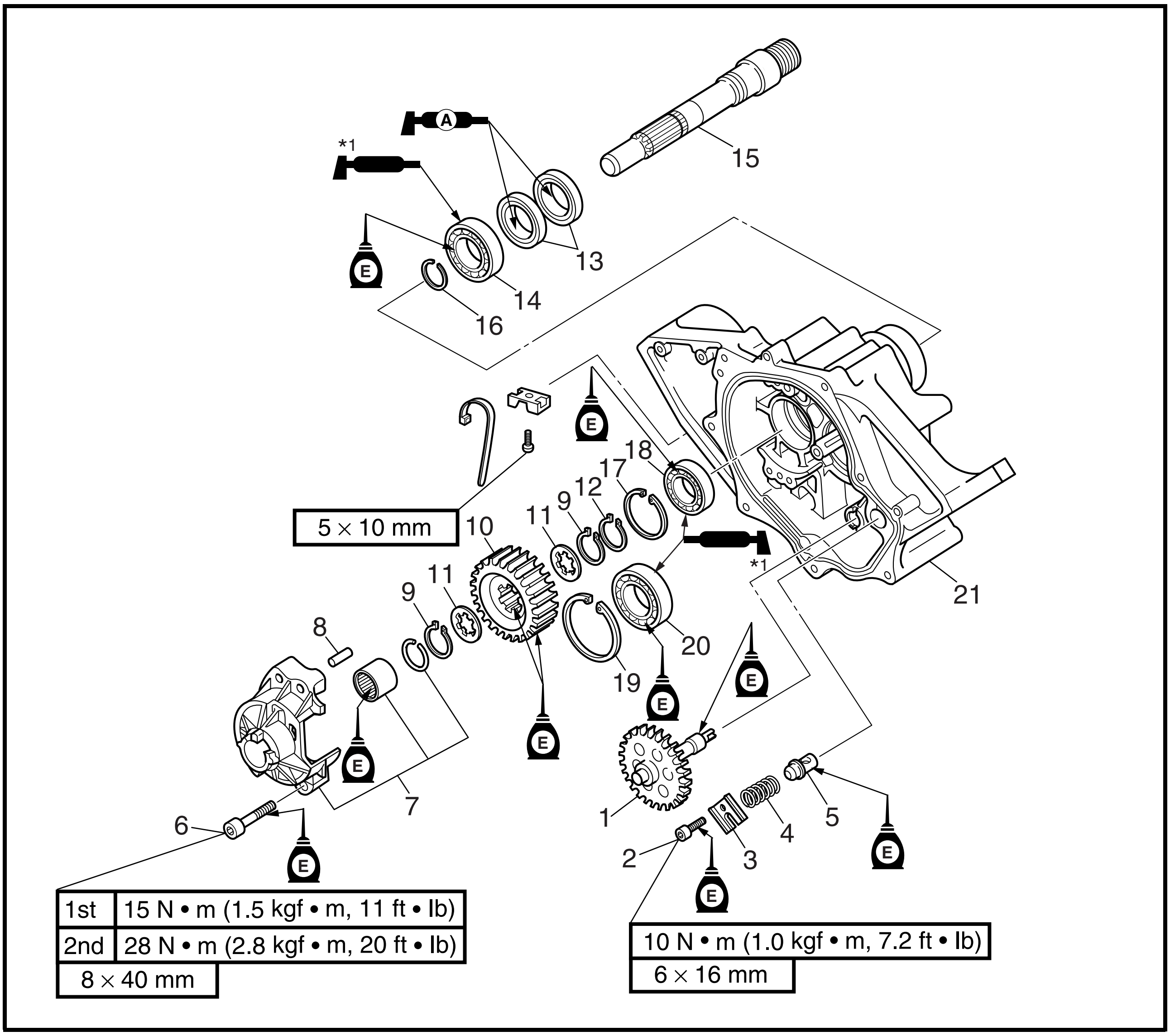



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **REDUCTION DRIVE GEAR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Oil pump driven gear | 1 | |
| 2 | Bolt | 1 | |
| 3 | Holder | 1 | |
| 4 | Spring | 1 | |
| 5 | Relief valve | 1 | |
| 6 | Bolt | 4 | |
| 7 | Bearing housing | 1 | |
| 8 | Pin | 2 | |

*1: EPNOC grease AP #0

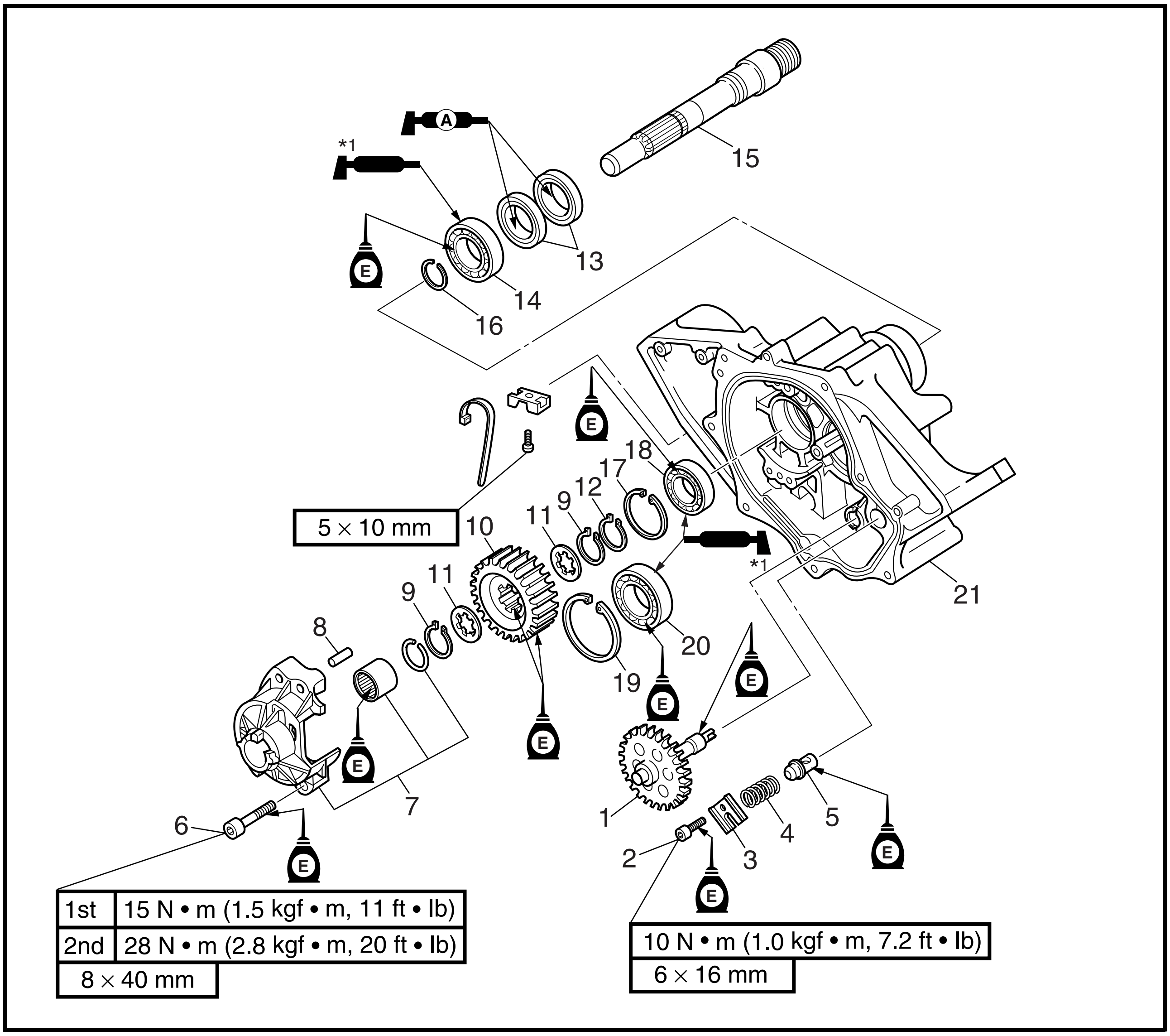
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Circlip | 2 | **Not reusable** |
| 10 | Driven gear | 1 | |
| 11 | Washer | 2 | |
| 12 | Circlip | 1 | **Not reusable** |
| 13 | Oil seal | 2 | **Not reusable** |
| 14 | Bearing | 1 | **NOTE:** Remove parts 12 to 15 as a set. |
| 15 | Drive shaft | 1 | **Not reusable** |
| 16 | Circlip | 1 | **Not reusable** |
| 17 | Circlip | 1 | **Not reusable** |

*1: EPNOC grease AP #0

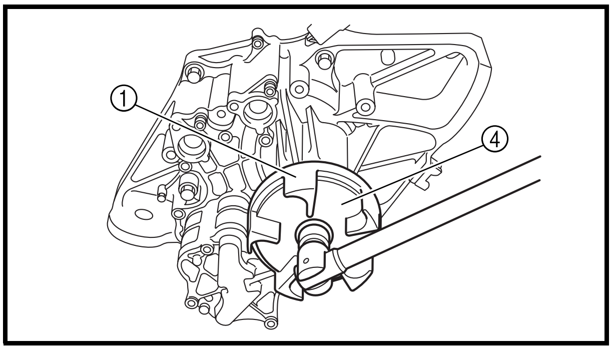
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 18 | Bearing | 1 | **Not reusable** |
| 19 | Circlip | 1 | **Not reusable** |
| 20 | Bearing | 1 | **Not reusable** |
| 21 | Reduction drive gear case | 1 | |
| | | | Reverse the disassembly steps for assembly. |

*1: EPNOC grease AP #0

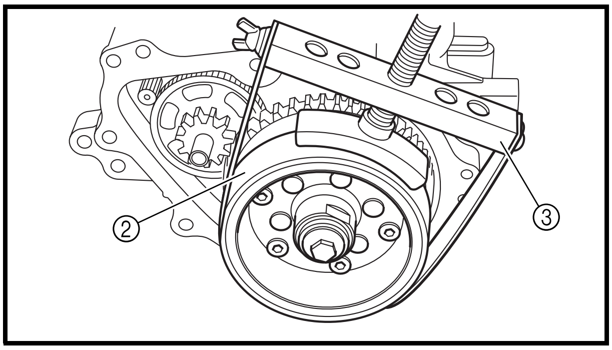
## SERVICE POINTS



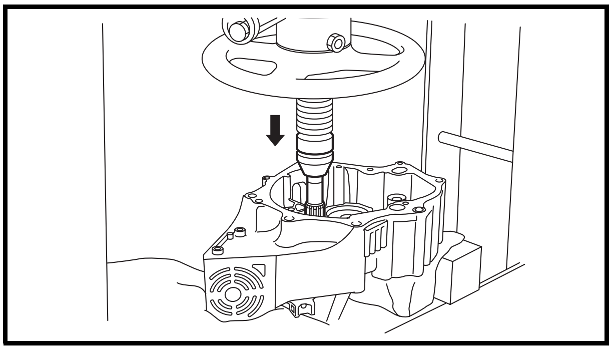

### Drive coupling removal

1. Remove:
   - Drive coupling ①

**NOTE:**
While holding the flywheel magneto ② with the sheave holder ③, loosen the drive coupling with coupler wrench ④.



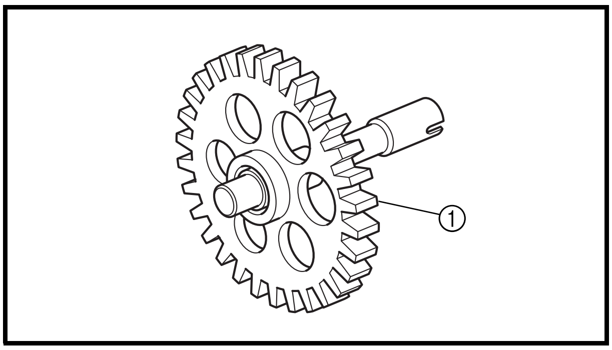

**Coupler wrench:**
**YW-06551/90890-06551**
**Sheave holder:**
**YS-01880-A/90890-01701**



### Drive shaft removal

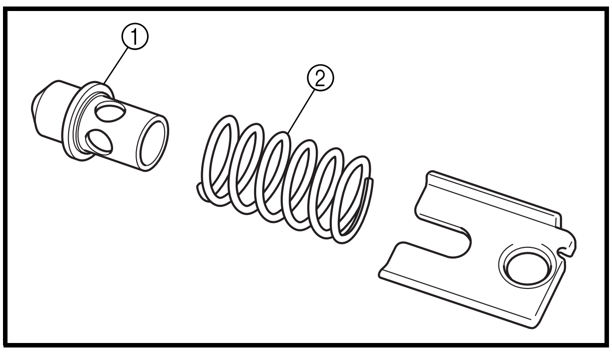
1. Remove:
   - Circlip
   - Drive shaft

**NOTE:**
Press in the direction of the arrow.



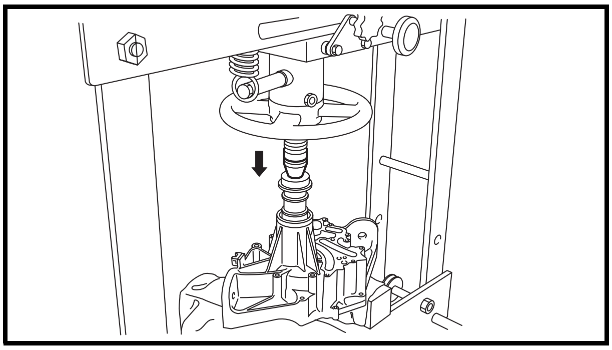

### Oil pump driven gear inspection

1. Check:
   - Oil pump driven gear ①
     Cracks/damage/wear → Replace.




### Relief valve inspection

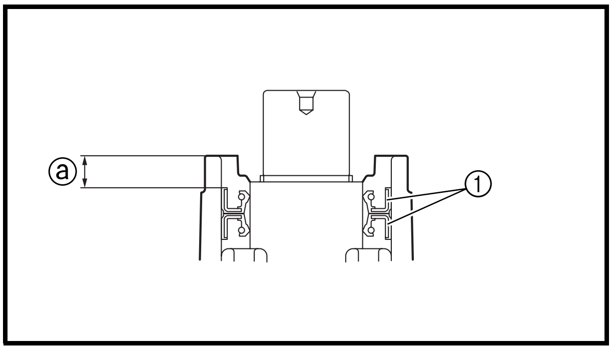
1. Check:
   - Relief valve ①
   - Spring ②
     Damage/wear → Replace the defective part(s).



**Drive shaft installing**

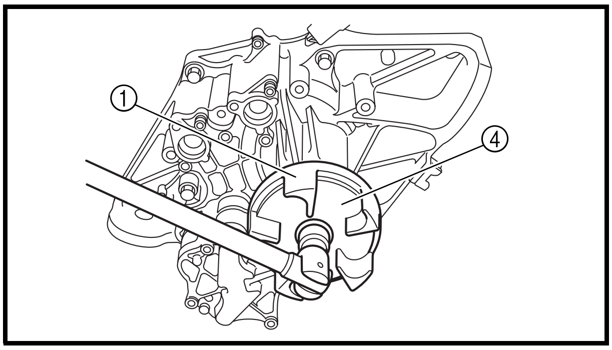
1. Install:
   - Drive shaft

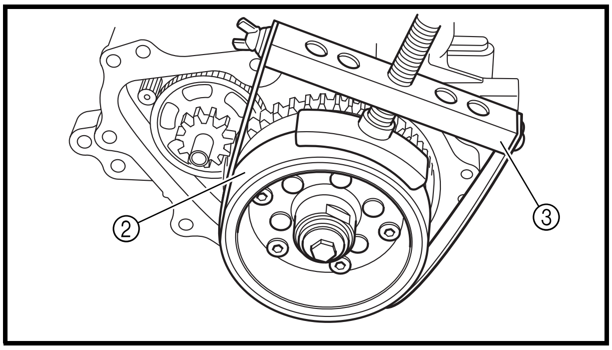
**NOTE:**
Press in the direction of the arrow.




2. Install:
   - Oil seals ①

| | |
|---|---|
| | **Distance ⓐ:**<br>**8.9–9.3 mm (0.35–0.37 in)** |



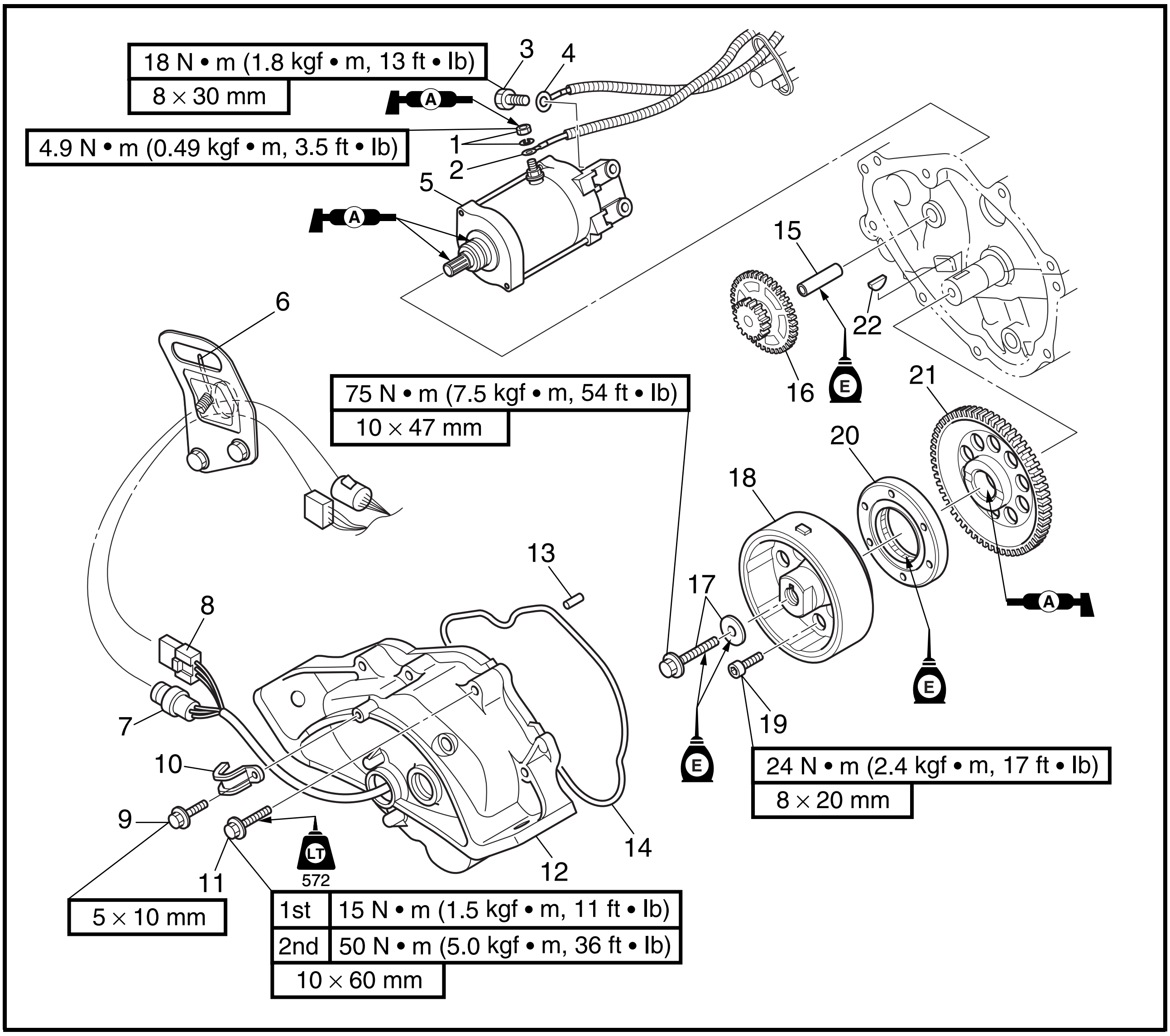

**Drive coupling installation**

1. Install:
   - Drive coupling ①

**NOTE:**
While holding the flywheel magneto ② with the sheave holder ③, tighten the drive coupling with coupler wrench ④.

| | |
|---|---|
| | **Coupler wrench:**<br>**YW-06551/90890-06551**<br>**Sheave holder:**<br>**YS-01880-A/90890-01701** |

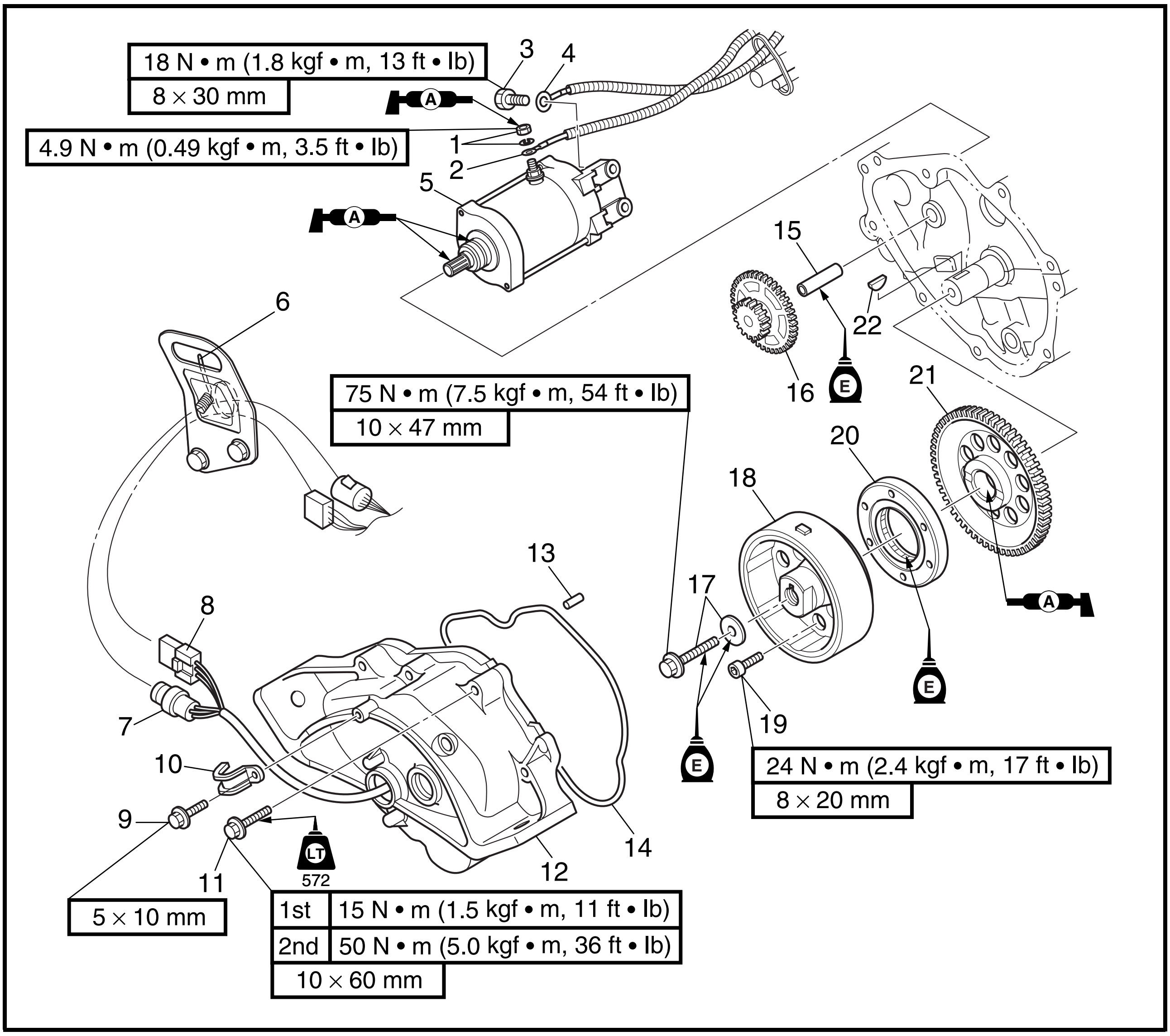
# GENERATOR AND STARTER MOTOR
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

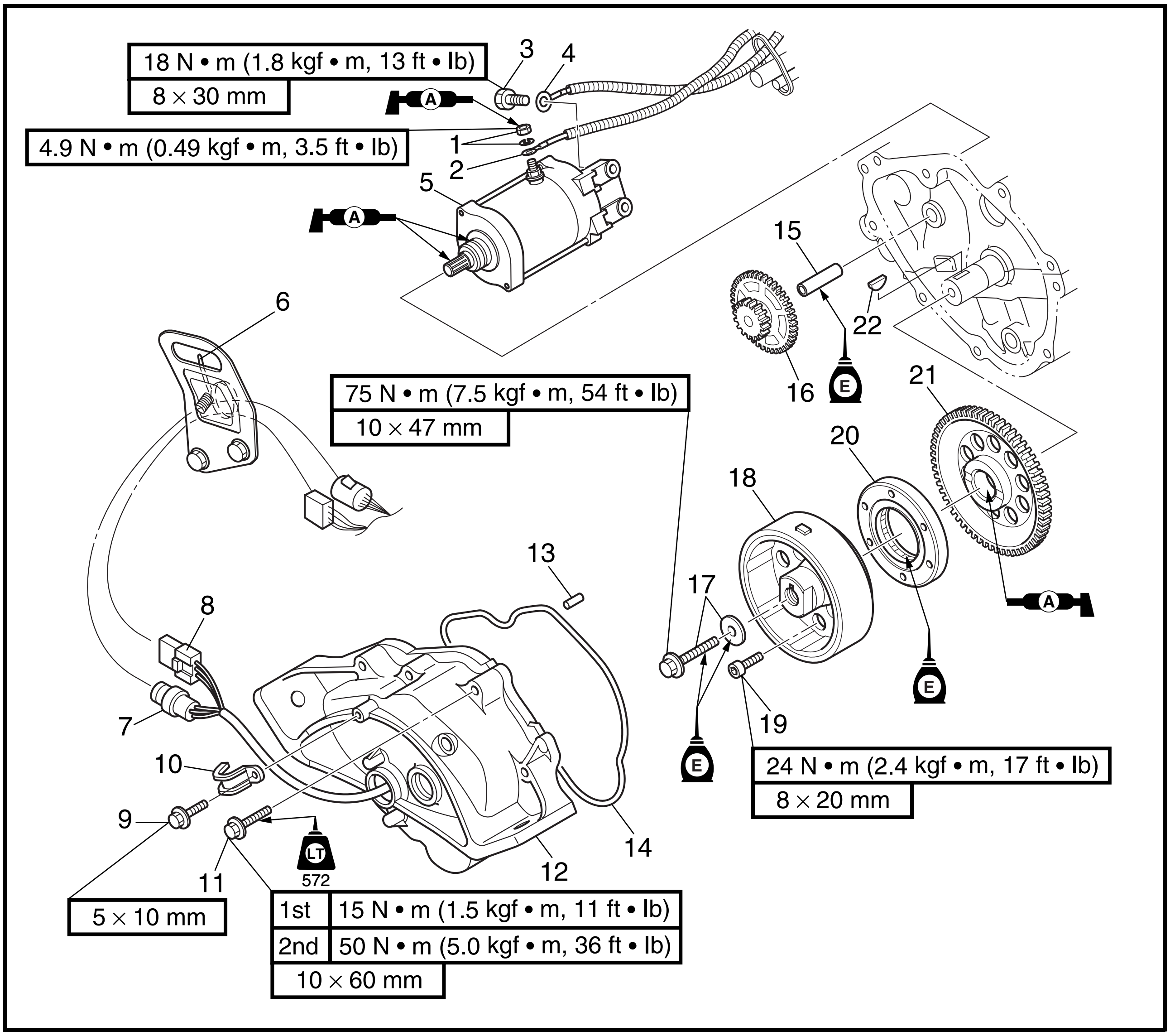
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **GENERATOR COVER AND FLYWHEEL MAGNET REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT". |
| 1 | Nut/washer | 1/1 | |
| 2 | Starter motor lead | 1 | |
| 3 | Bolt | 2 | |
| 4 | Battery negative lead | 1 | |
| 5 | Starter motor | 1 | |
| 6 | Band | 1 | |
| 7 | Lighting coil coupler | 1 | |
| 8 | Pulser coil coupler | 1 | |

## EXPLODED DIAGRAM



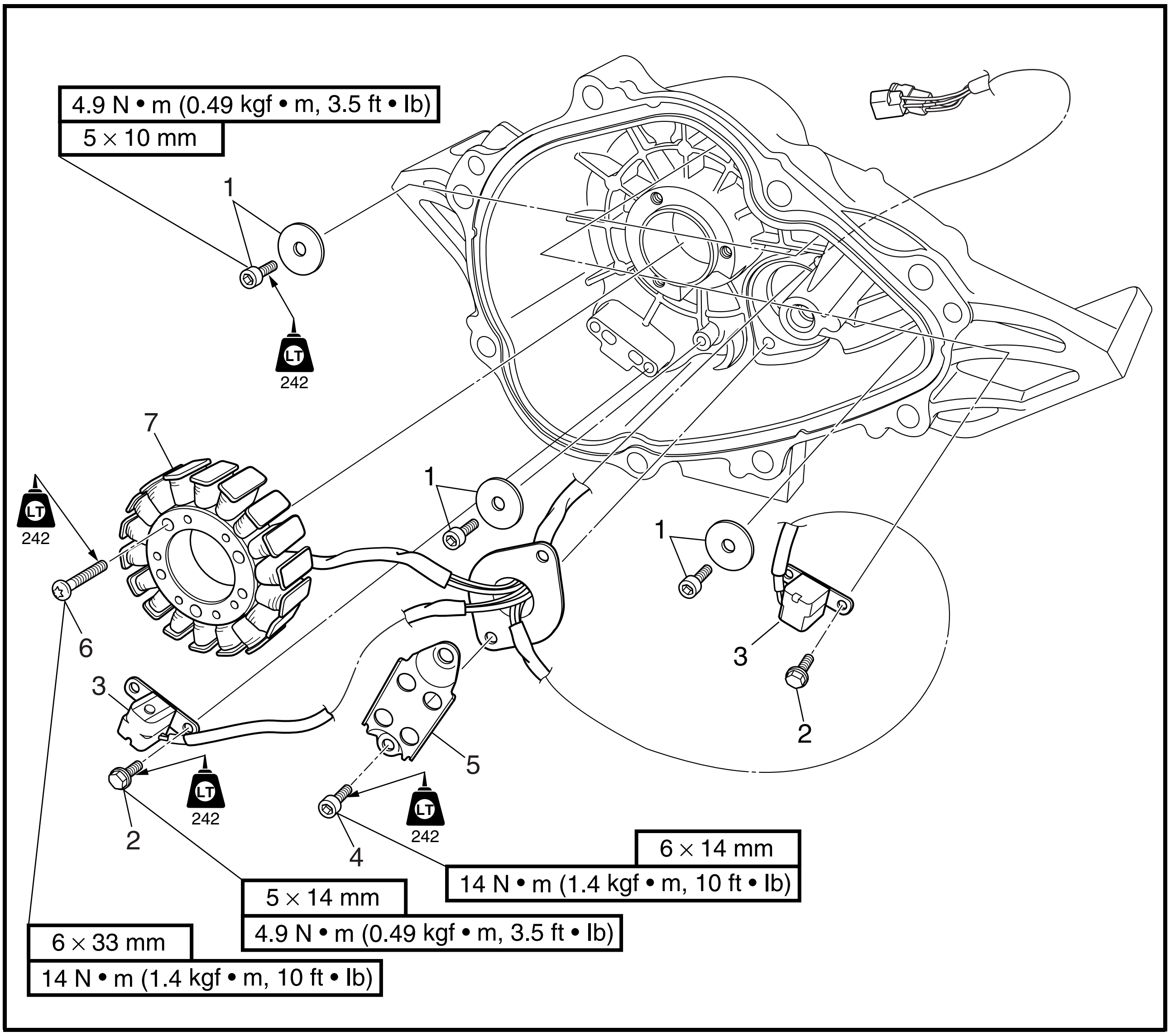

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Bolt | 1 | |
| 10 | Holder | 1 | |
| 11 | Bolt | 8 | |
| 12 | Generator cover | 1 | |
| 13 | Dowel pin | 2 | |
| 14 | Packing | 1 | **Not reusable** |
| 15 | Idle gear shaft | 1 | |
| 16 | Idle gear | 1 | |
| 17 | Bolt/washer | 1/1 | **Not reusable** |
| 18 | Rotor | 1 | |
| 19 | Bolt | 6 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 20 | Starter clutch | 1 | |
| 21 | Starter gear | 1 | |
| 22 | Woodruff key | 1 | |
| | | | Reverse the removal steps for installation. |

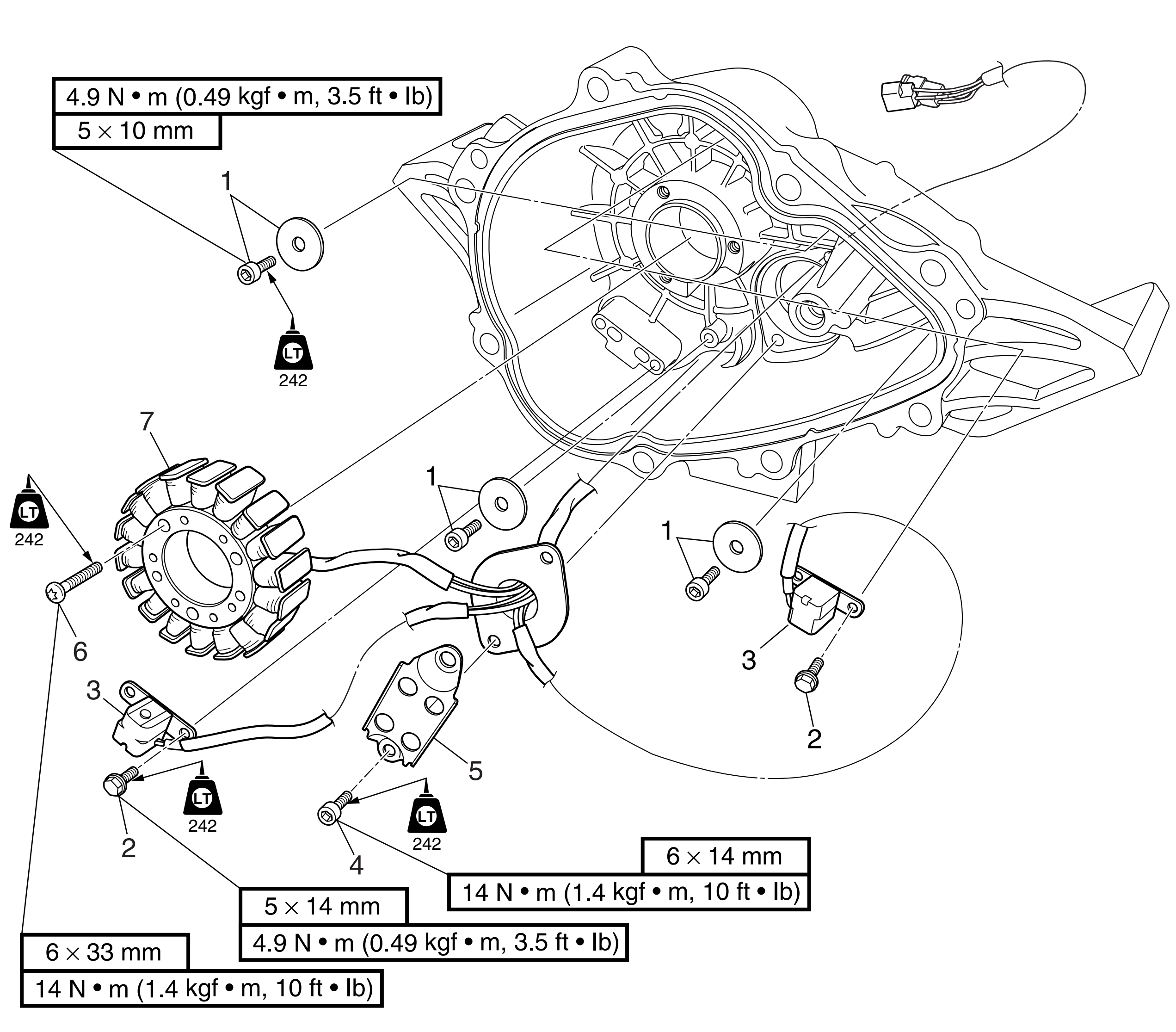
## EXPLODED DIAGRAM



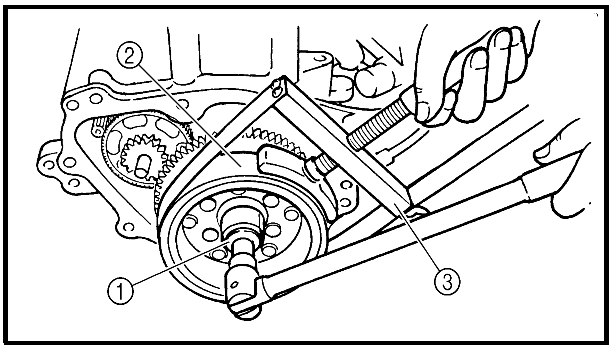

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **GENERATOR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt/washer | 3/3 | |
| 2 | Bolt | 4 | |
| 3 | Pulser coil | 2 | **NOTE:** There washers holds the pulser coil lead. Make sure to not pitch the lead between the projection and the washer when installing the bolt. |
| 4 | Bolt | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 5 | Holder | 1 | |
| 6 | Bolt | 3 | |
| 7 | Lighting coil | 1 | |
| | | | Reverse the disassembly steps for assembly. |



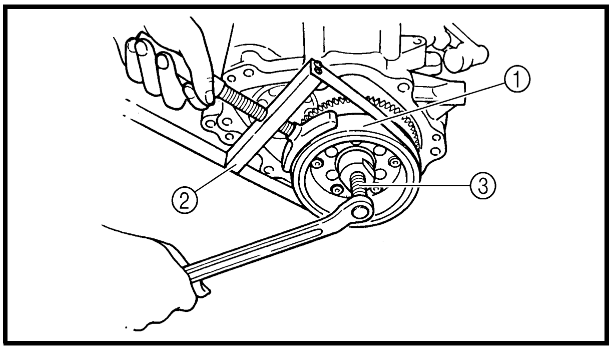

## SERVICE POINTS

### Flywheel magneto removal

1. Remove:
   - Flywheel magneto bolt ①
   - Washer

**NOTE:**
While holding the flywheel magneto ② with the sheave holder ③, loosen the flywheel magneto bolt.

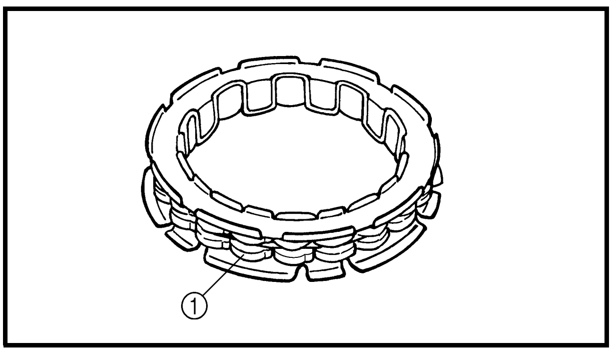
| | |
|---|---|
| | **Sheave holder:**<br>**YS-01880-A/90890-01701** |




2. Remove:
   - Flywheel magneto ①
   - Woodruff key

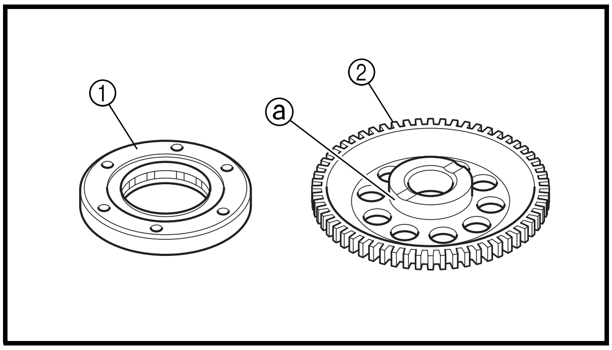
**NOTE:**
While holding the flywheel magneto with sheave holder ②, remove the flywheel magneto with the rotor puller ③.

| | |
|---|---|
| | **Rotor puller:**<br>**YM-01082/90890-01080** |

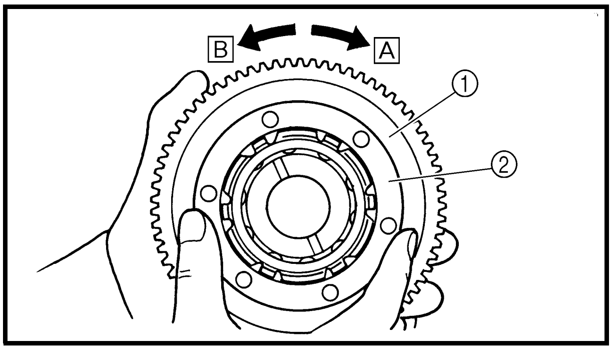



### Starter clutch inspection

1. Check:
   - Starter clutch rollers ①
     Damage/wear → Replace.




2. Check:
   - Starter clutch ①
   - Starter gear ②
     Burrs/chips/roughness/wear → Replace the defective part(s).
3. Check:
   - Starter clutch gear's contacting surfaces ⓐ
     Damage/pitting/wear → Replace the starter clutch gear.




4. Check:
   - Starter clutch operation

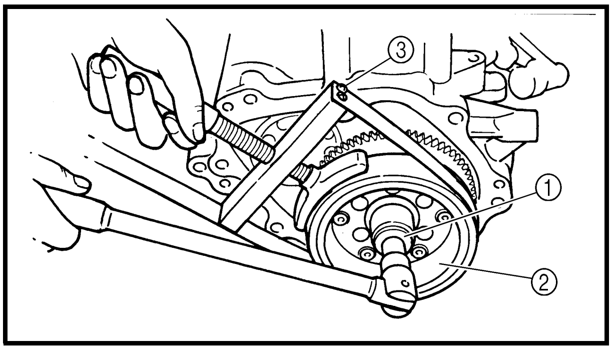
**Checking steps:**
- Install the starter gear ① onto the starter clutch ② and hold the starter clutch.
- When turning the starter gear clockwise [A], it should turn freely, otherwise the starter clutch is faulty and must be replaced.
- When turning the starter gear counterclockwise [B], the starter clutch and the starter gear should engage, otherwise the starter clutch is faulty and must be replaced.

**Flywheel magneto installation**

1. Install:
   - Woodruff key
   - Flywheel magneto
   - Washer
   - Flywheel magneto bolt

**NOTE:**

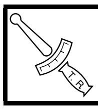
- Clean the tapered portion of the crankshaft and the flywheel magneto hub.
- When installing the flywheel magneto, make sure the woodruff key is properly seated in the keyway of the crankshaft.
- Lubricate the flywheel magneto bolt and washer with engine oil.

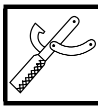



2. Tighten:
   - Flywheel magneto bolt ①

**NOTE:**

While holding the flywheel magneto ② with the sheave holder ③, tighten the flywheel magneto bolt.

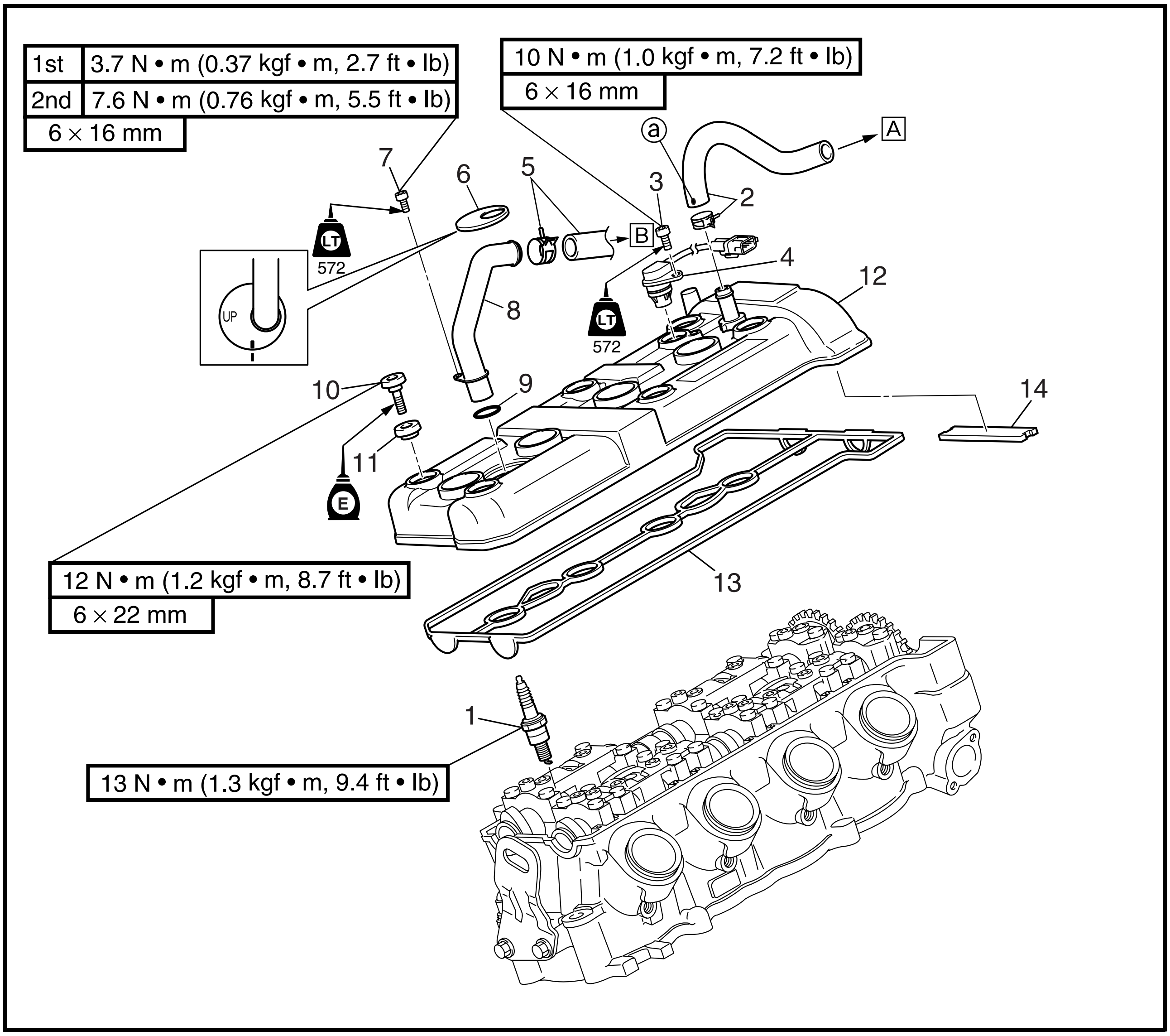
| | |
|---|---|
|  | **Flywheel magneto bolt:**<br>**75 N • m (7.5 kgf • m, 54 ft • lb)** |

| | |
|---|---|
|  | **Sheave holder:**<br>**YS-01880-A/90890-01701** |

**CAUTION:**

**Do not reuse the flywheel magnet bolt and washer, always replace them with new ones.**

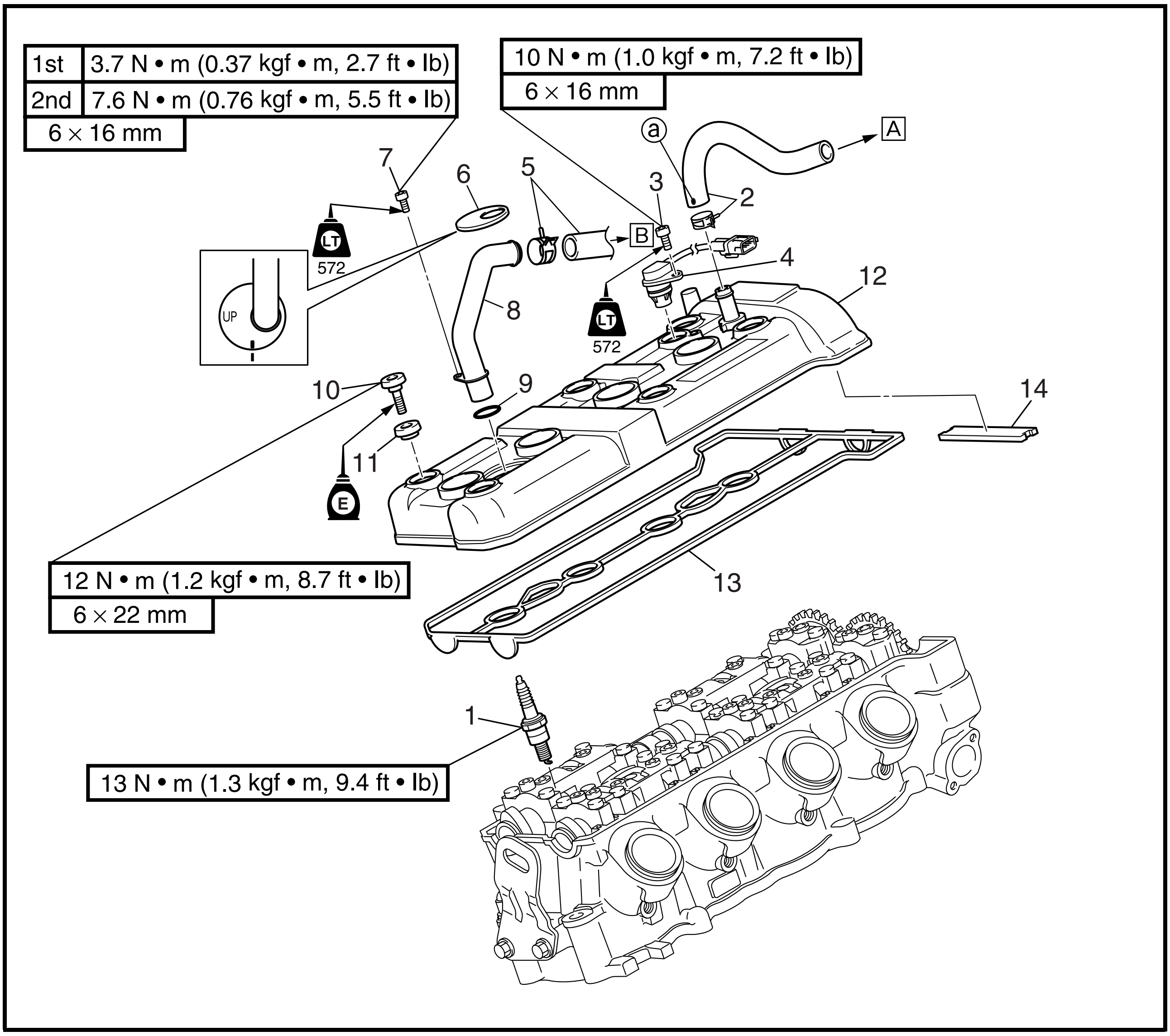
# CAMSHAFTS
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

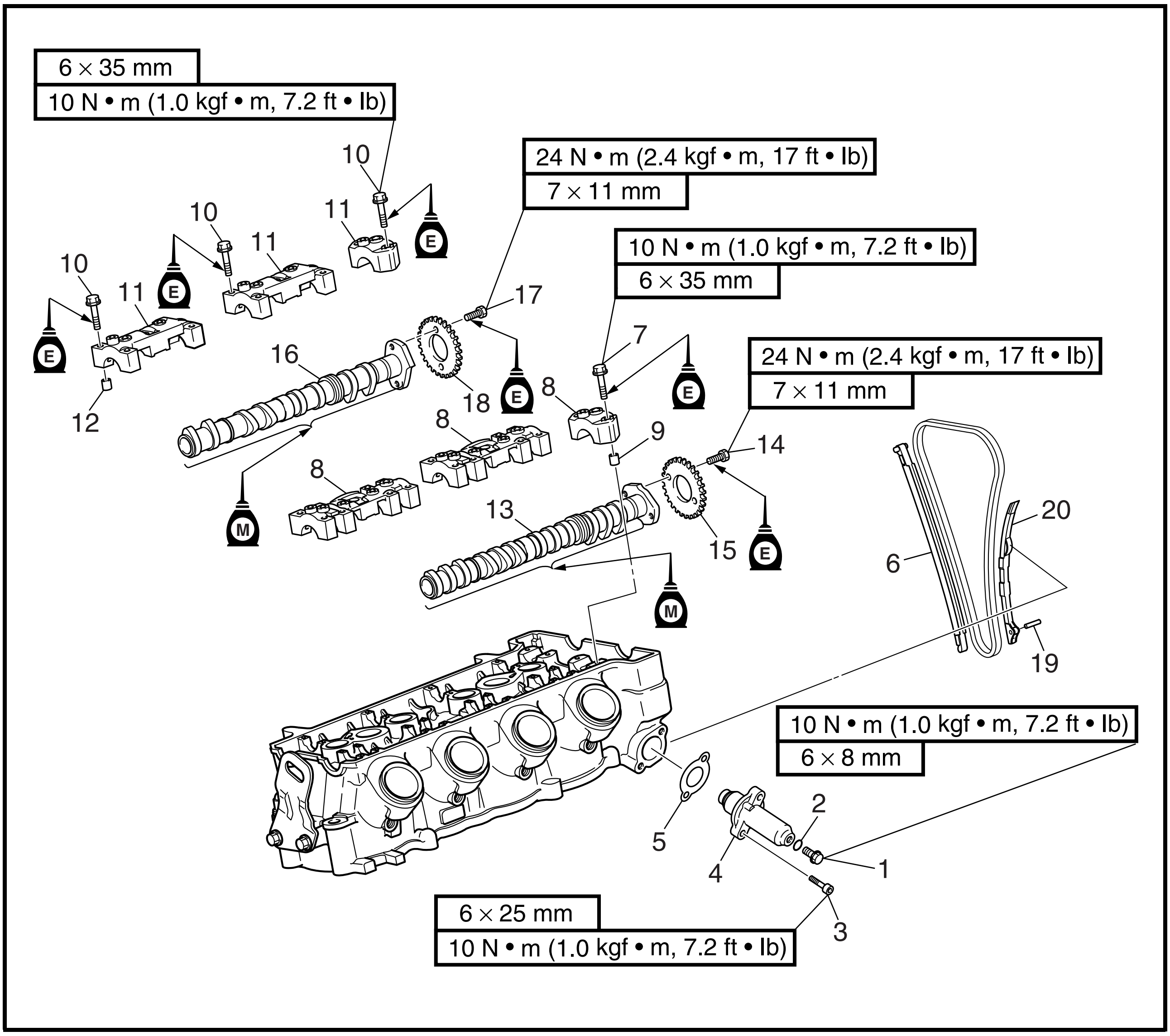
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CYLINDER HEAD COVER REMOVAL** | | Follow the left "Step" for removal. |
| | Air filter case | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| 1 | Spark plug | 4 | |
| 2 | Clamp/breather hose | 1/1 | A To oil tank<br>White mark ⓐ |
| 3 | Bolt | 1 | |
| 4 | Camshaft position sensor | 1 | |
| 5 | Clamp/cooling water hose | 1/1 | B To thermostat |
| 6 | Rubber seal | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Bolt | 1 | |
| 8 | Cooling water pipe | 1 | |
| 9 | O-ring | 1 | Not reusable |
| 10 | Bolt | 6 | |
| 11 | Rubber mount | 6 | |
| 12 | Cylinder head cover | 1 | |
| 13 | Cylinder head cover gasket | 1 | Not reusable |
| 14 | Timing chain guide (top side) | 1 | |
| | | | Reverse the removal steps for installation. |

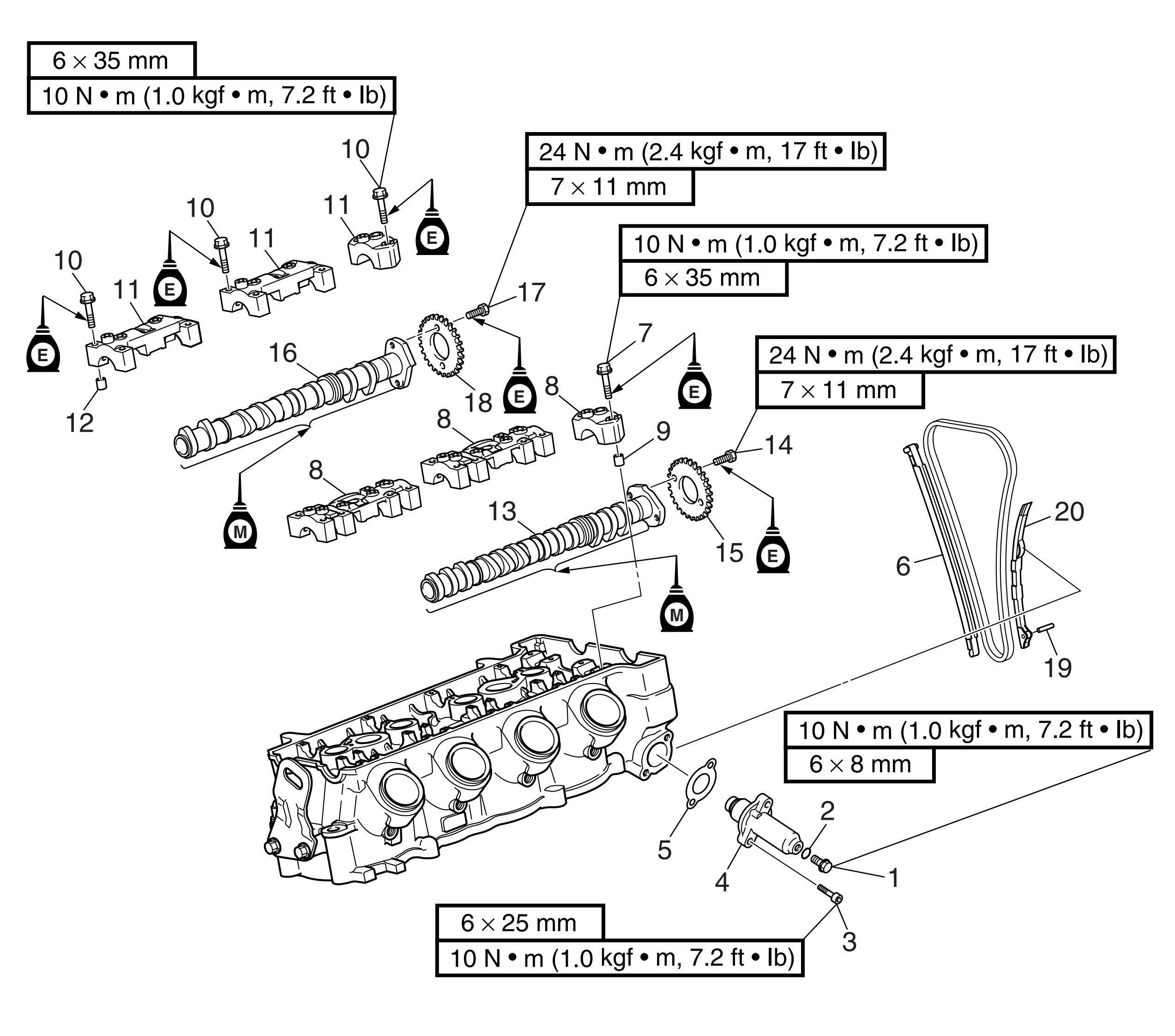
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

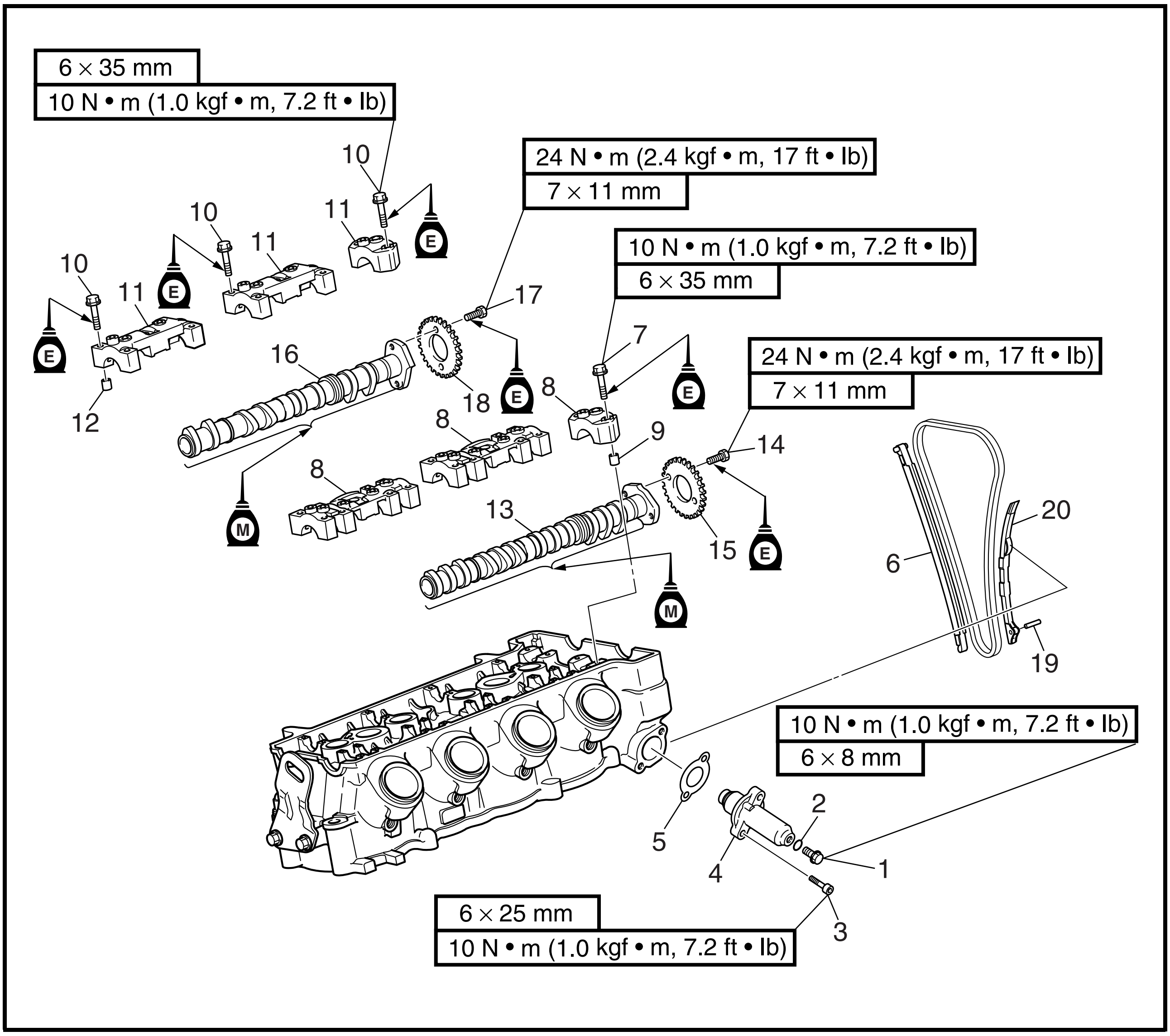
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CAMSHAFT REMOVAL** | | Follow the left "Step" for removal. |
| | Cylinder head cover | | |
| | Reduction drive gear case | | Refer to "REDUCTION DRIVE GEAR".<br>**NOTE:**<br>When removing camshafts it is not necessary to remove the reduction drive gear case. |
| 1 | Cap bolt | 1 | |
| 2 | Gasket | 1 | **Not reusable** |
| 3 | Bolt | 2 | |
| 4 | Timing chain tensioner | 1 | |

## EXPLODED DIAGRAM

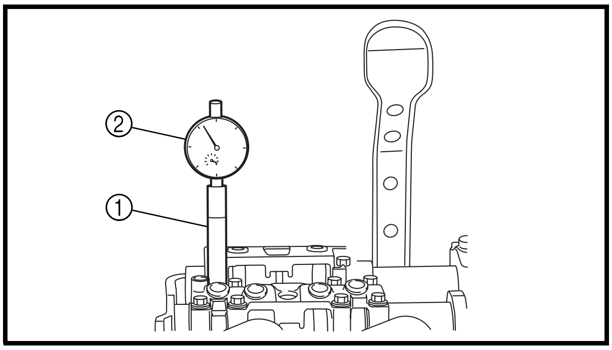



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 5 | Timing chain tensioner gasket | 1 | **Not reusable** |
| 6 | Timing chain guide (exhaust side) | 1 | |
| 7 | Bolt | 18 | |
| 8 | Intake camshaft cap | 3 | |
| 9 | Dowel pin | 6 | **NOTE:** During removal, the dowel pins may still be connected to the camshaft caps. |
| 10 | Bolt | 10 | |
| 11 | Exhaust camshaft cap | 3 | |
| 12 | Dowel pin | 6 | |
| 13 | Intake camshaft | 1 | |
| 14 | Bolt | 2 | |
| 15 | Intake camshaft sprocket | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 16 | Exhaust camshaft | 1 | |
| 17 | Bolt | 2 | |
| 18 | Exhaust camshaft sprocket | 1 | |
| 19 | Pin | 1 | |
| 20 | Timing chain guide (intake side) | 1 | |
| | | | Reverse the removal steps for installation. |

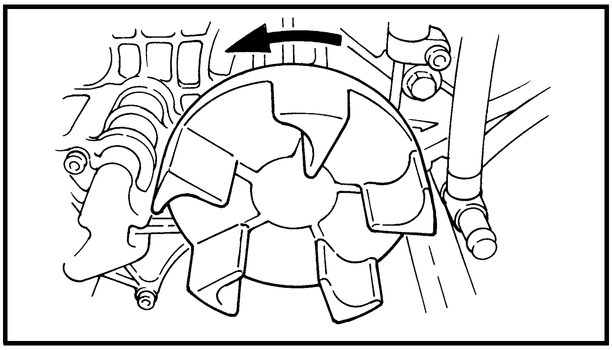



## SERVICE POINTS

### Camshaft removal

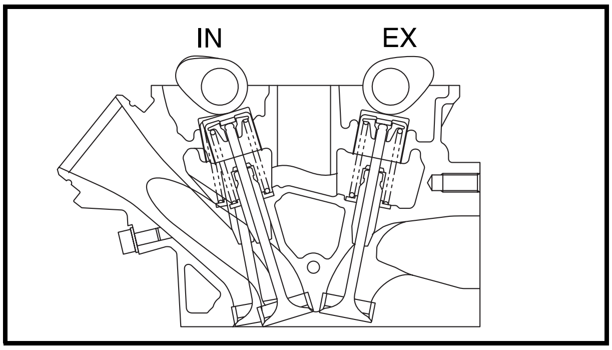
1. Install:
   - Dial gauge needle
   - Dial gauge stand ①
     (into spark plug hole #1)
   - Dial gauge ②

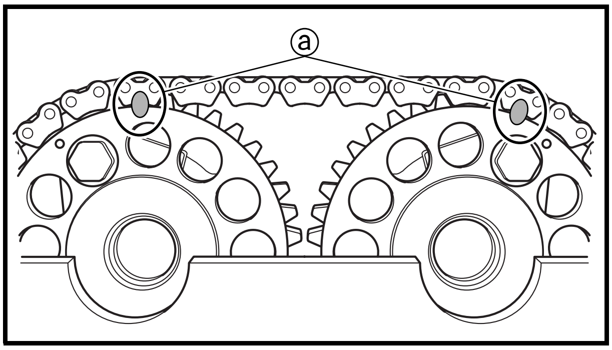
**Dial gauge stand:**
**90890-06583**
**Dial gauge needle:**
**90890-06584**
**Dial gauge stand set:**
**YW-06585/90890-06585**
**Dial gauge:**
**YU-03097/90890-01252**



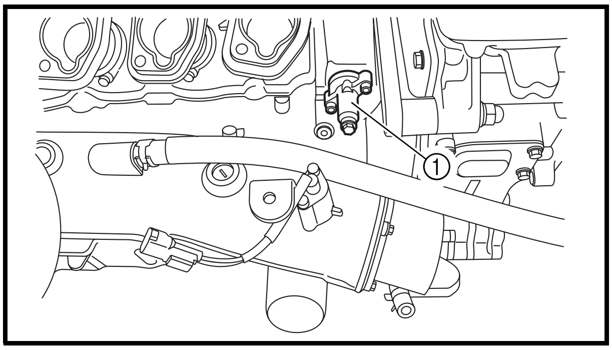
2. Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.

**NOTE:**
TDC on the compression stroke can be found when the camshaft lobes are turned away from each other.

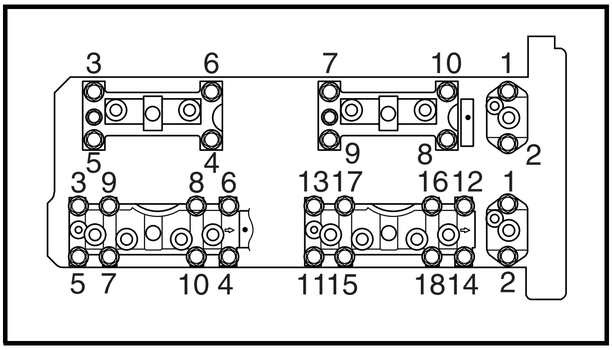



3. Make an alignment mark ⓐ on the timing chain and camshaft sprockets.

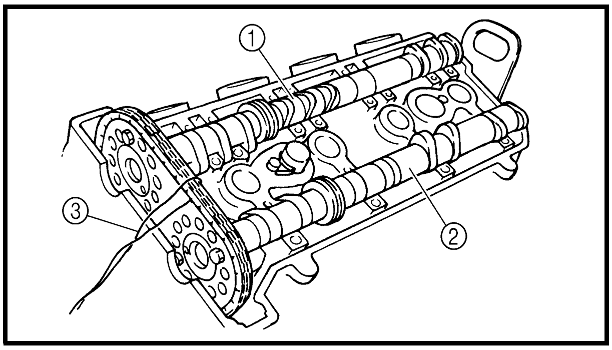



4. Remove:
   - Timing chain tensioner ①
   - Gasket



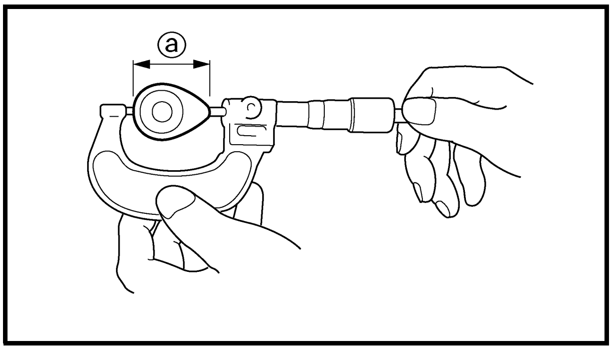

5. Remove:
   - Camshaft caps
   - Dowel pins

**NOTE:**
Loosen the intake and exhaust camshaft cap bolts in the sequence shown.



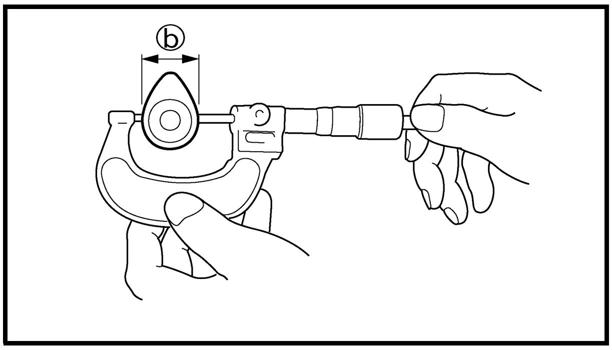

6. Remove:
   - Intake camshaft ①
   - Exhaust camshaft ②

**NOTE:**
To prevent the timing chain from falling into the crankcase, fasten it with a wire ③.

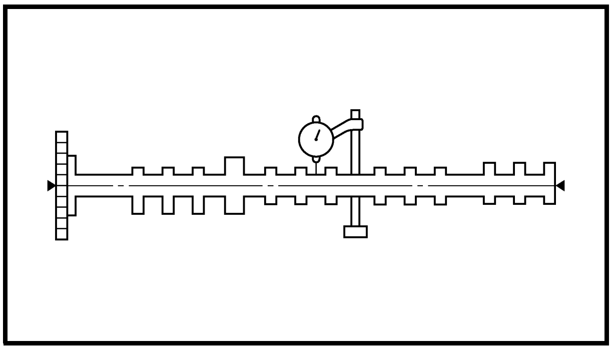



**Camshaft inspection**

1. Check:
   - Camshaft lobes
     Blue discoloration/pitting/scratches → Replace the camshaft.
2. Measure:
   - Camshaft lobe dimensions ⓐ and ⓑ
     Out of specification → Replace the camshaft.




**Minimum cam lobe dimensions:**
**Intake camshaft:**
**ⓐ 32.25 mm (1.270 in)**
**ⓑ 25.00 mm (0.984 in)**
**Exhaust camshaft:**
**ⓐ 32.65 mm (1.285 in)**
**ⓑ 25.00 mm (0.984 in)**

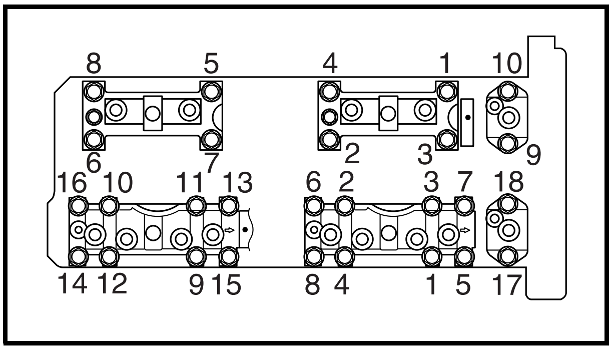


3. Measure:
   - Camshaft runout
     Out of specification → Replace.

| | |
|---|---|
| | **Maximum camshaft runout:** **0.03 mm (0.0012 in)** |

4. Measure:
   - Camshaft-journal-to-camshaft-cap clearance
     Out of specification → Measure the camshaft journal diameter.

| | |
|---|---|
| | **Camshaft-journal-to-camshaft-cap clearance:** **0.05–0.08 mm (0.0020–0.0031 in)** |

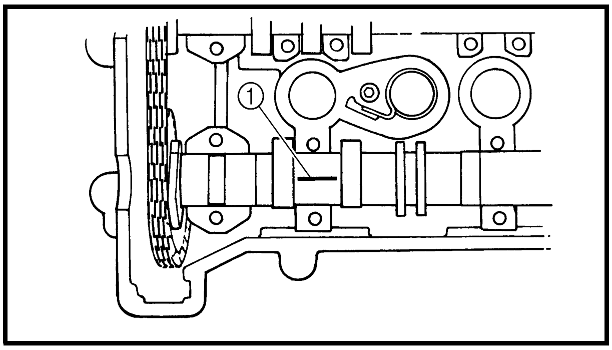


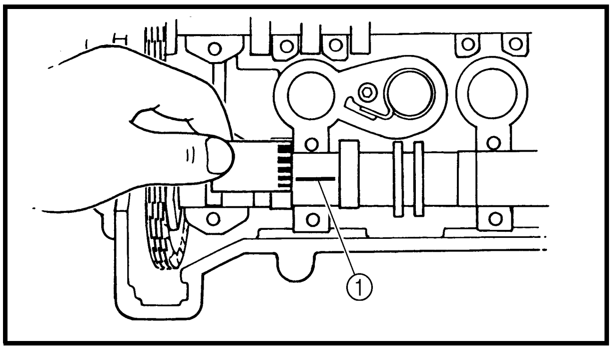

**Measurement steps:**
- Install the camshaft into the cylinder head (without the dowel pins and camshaft caps).
- Position a strip of Plastigauge® ① onto the camshaft journal as shown.
- Install the dowel pins and camshaft caps.

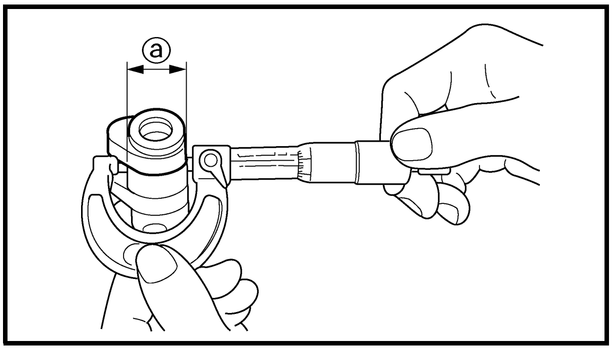
**NOTE:**
- Tighten the intake and exhaust camshaft cap bolts in the sequence shown.
- Do not turn the camshaft when measuring the camshaft journal-to-camshaft cap clearance with the Plastigauge®.

| | |
|---|---|
| | **Camshaft cap bolt:** **10 N • m (1.0 kgf • m, 7.2 ft • lb)** |

- Remove the camshaft caps and then measure the width of the Plastigauge® ①.

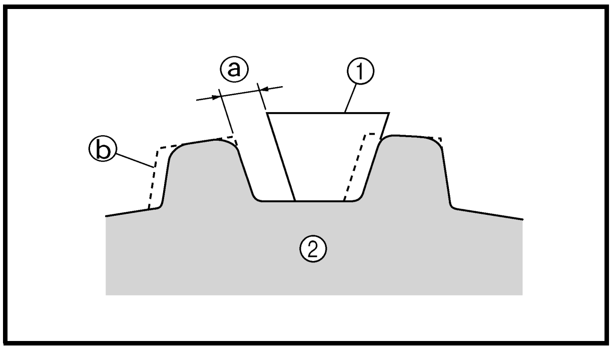





5. Measure:
   - Camshaft journal diameter ⓐ
     Out of specification → Replace the camshaft.
     Within specification → Replace the cylinder head and the camshaft caps as a set.

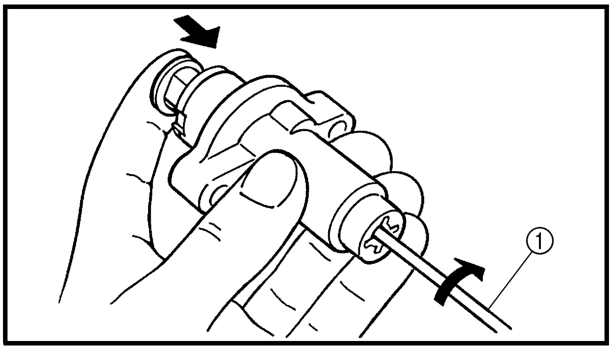
**Camshaft journal diameter:**
**24.44–24.45 mm**
**(0.9622–0.9626 in)**

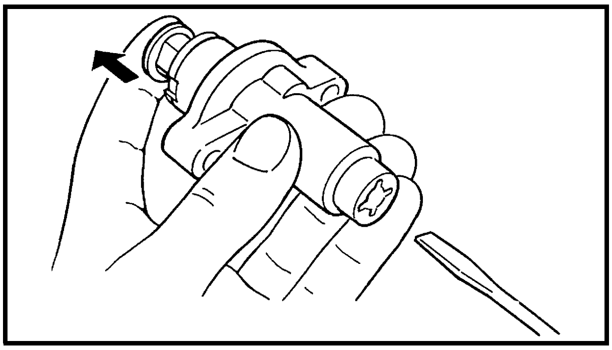



**Camshaft sprockets inspection**

1. Check:
   - Camshaft sprocket
     Wear/damage → Replace the camshaft sprockets and timing chain as a set.

ⓐ 1/4 of a tooth
ⓑ Correct
① Timing chain
② Camshaft sprocket

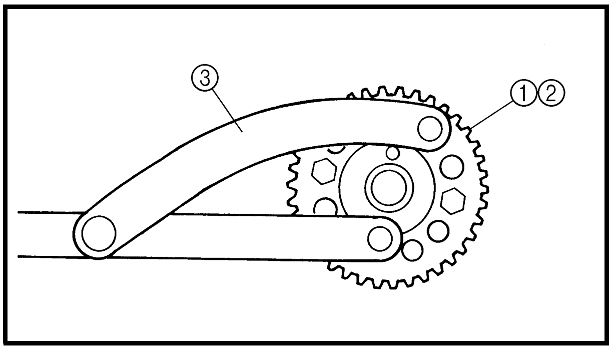


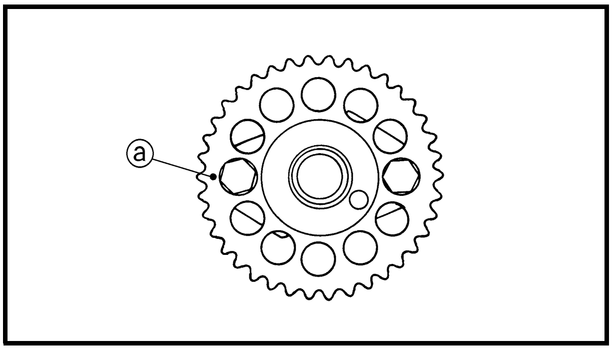



**Timing chain tensioner inspection**

1. Check:
   - Timing chain tensioner
     Cracks/damage/rough movement → Replace.

**Checking steps:**
- While lightly pressing the timing chain tensioner rod by hand, turn the tensioner rod fully clockwise with a thin screwdriver ①.
- Remove the screwdriver and slowly release the timing chain tensioner rod.
- Make sure that the timing chain tensioner rod comes out of the timing chain tensioner housing smoothly. If there is rough movement, replace the timing chain tensioner.



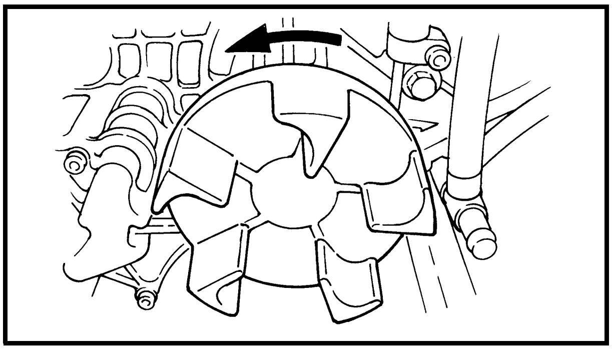

**Camshaft installation**

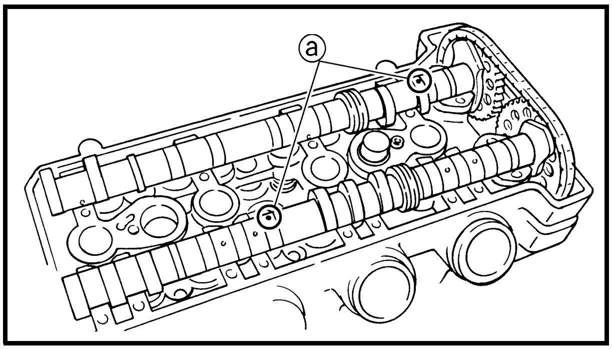
1. Install:
   - Exhaust camshaft sprocket ①
   - Intake camshaft sprocket ②
     (with the special tool ③)

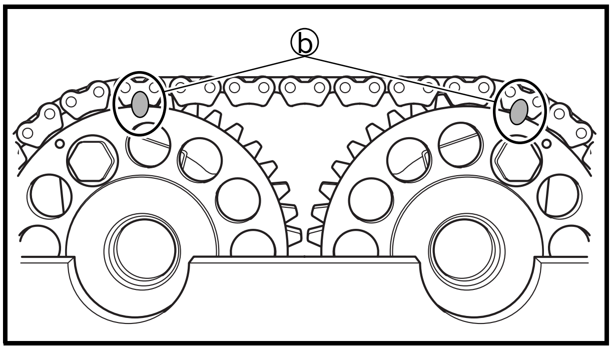
| | |
|---|---|
| | **Rotor holder:**<br>**YU-01235/90890-01235** |

**NOTE:**
Install the camshaft sprocket with the punch mark ⓐ facing outside.

| | |
|---|---|
| | **Camshaft sprocket bolt:**<br>**24 N • m (2.4 kgf • m, 17 ft • lb)** |





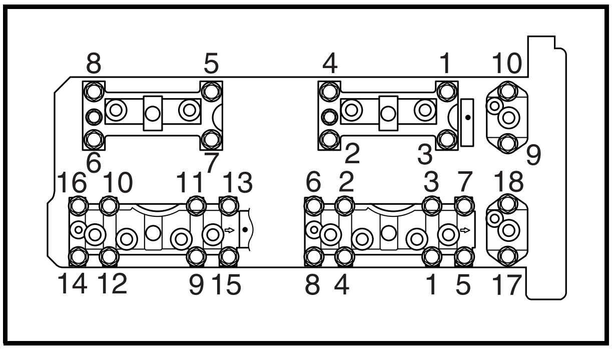

2. Install:
   - Exhaust camshaft
   - Intake camshaft
   - Exhaust camshaft caps
   - Intake camshaft caps

**Installation steps:**
- Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.
- Install the timing chain onto both camshaft sprockets and then install the camshaft sprockets onto the camshafts.

**CAUTION:**

**Do not turn the crankshaft when installing the camshaft to avoid damage or improper valve timing.**

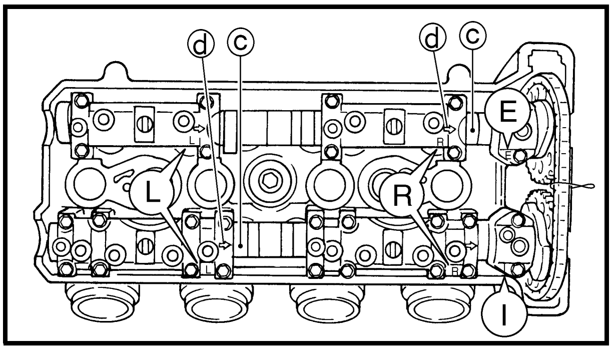
**NOTE:**
- Make sure that the punch marks ⓐ on the camshafts face up.
- Be sure to align the alignment mark ⓑ made during removal to install the timing chain and camshaft sprockets.




- Install the exhaust and intake camshaft caps.

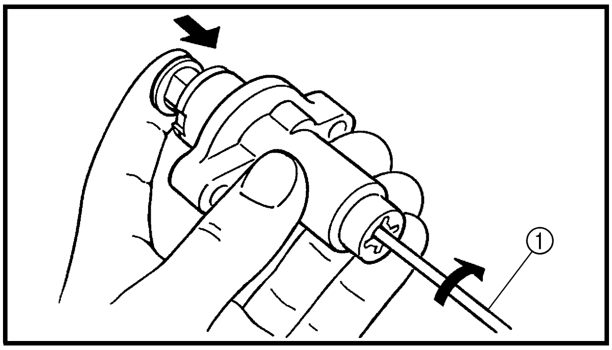
**NOTE:**
Gradually tighten the intake and exhaust camshaft cap bolts in 2–3 steps in the sequence shown.

| | |
|---|---|
| | **Camshaft cap bolt:**<br>**10 N • m (1.0 kgf • m, 7.2 ft • lb)** |




**NOTE:**
Make sure that the punch marks ⓒ on the camshafts are aligned with the arrow marks ⓓ on the camshaft caps.
Out of alignment → Reinstall.

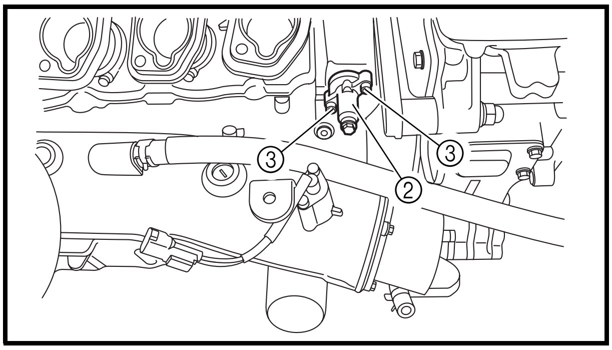
- Remove the wire from the timing chain.




3. Install:
   - Timing chain tensioner

**Installation steps:**
- While lightly pressing the timing chain tensioner rod by hand, turn the tensioner rod fully clockwise with a thin screwdriver ①.

**NOTE:**
Make sure that the tensioner rod has been fully set clockwise.




- With the timing chain tensioner rod turned all the way into the timing chain tensioner housing (with the thin screwdriver still installed), install the gasket and the timing chain tensioner ② onto the cylinder block.

**⚠ WARNING**
**Always use a new gasket.**

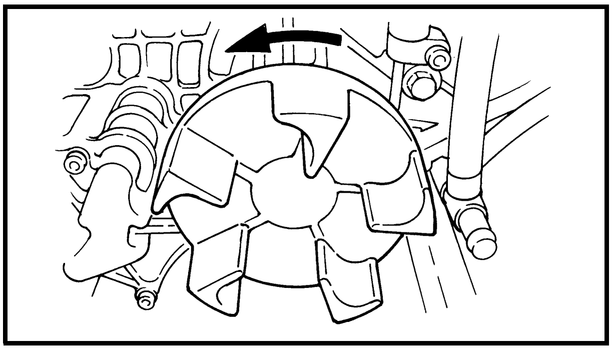
- Tighten the timing chain tensioner bolts ③ to the specified torque.

**NOTE:**
The “UP” mark on the timing chain tensioner should face up.

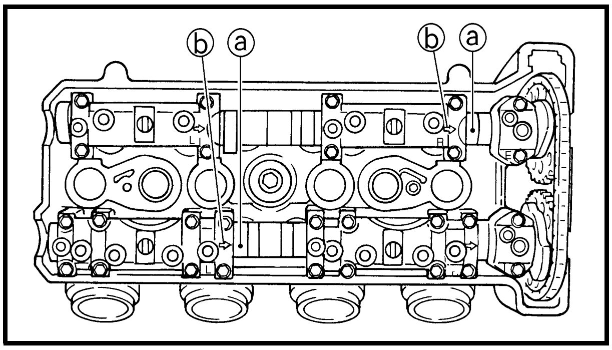
| | |
|---|---|
| | **Timing chain tensioner bolt:** **10 N • m (1.0 kgf • m, 7.2 ft • lb)** |

- Remove the screwdriver, make sure the timing chain tensioner rod releases, and then tighten the cap bolt to the specified torque.

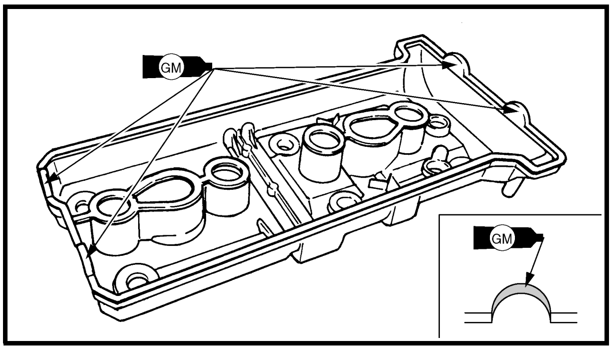
| | |
|---|---|
| | **Cap bolt:** **10 N • m (1.0 kgf • m, 7.2 ft • lb)** |



4. Turn:
   - Drive coupling
     (several turns counterclockwise)




5. Check:
   Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.
   - Camshaft punch mark ⓐ
     Make sure that the camshaft punch mark is aligned with the arrow mark ⓑ on the camshaft cap.
     Out of alignment → Adjust.
     Refer to the installation steps above.
6. Measure:
   - Valve clearance
     Out of specification → Adjust.
     Refer to “POWER UNIT” in Chapter 3.



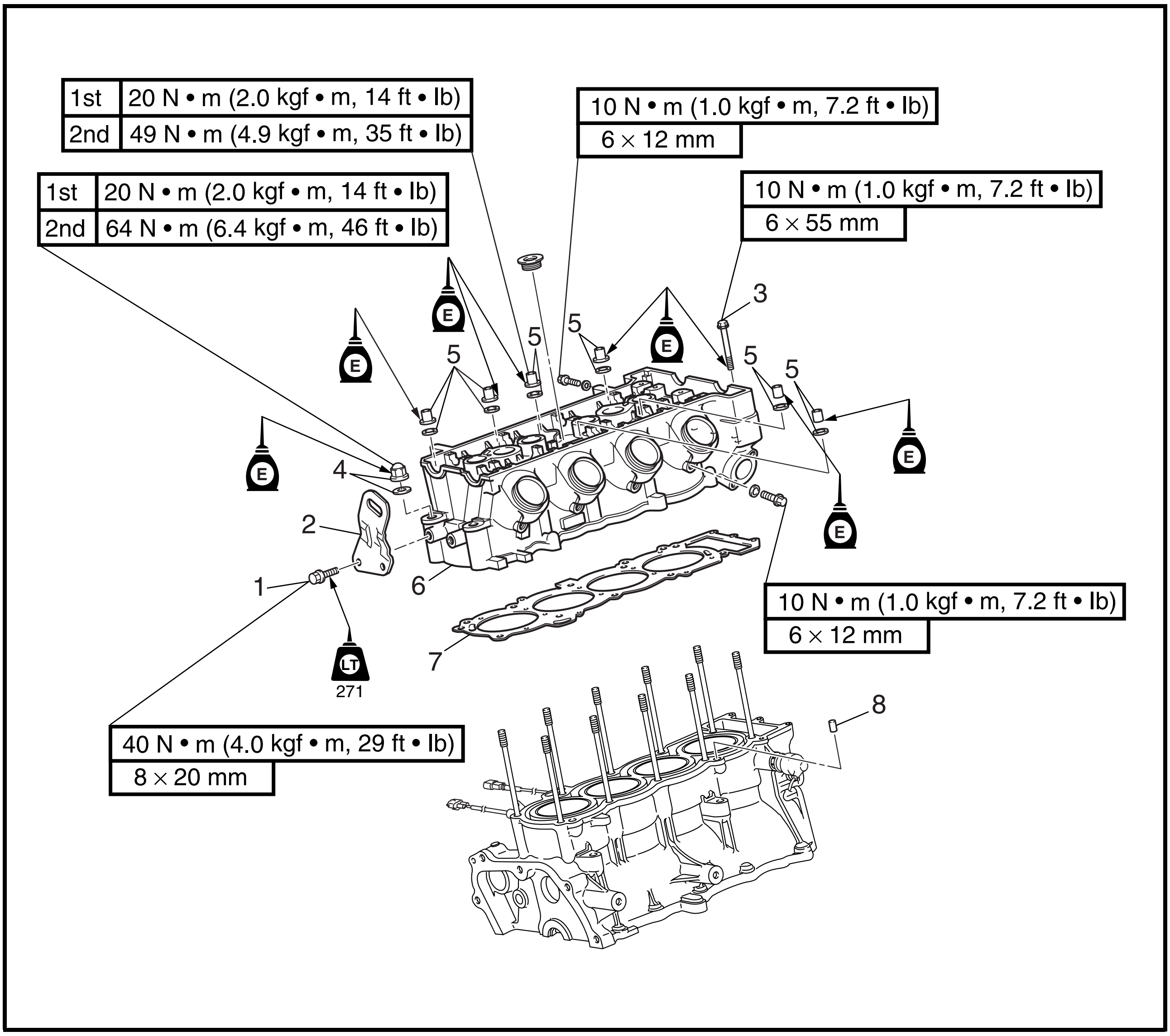

7. Install:
   - Cylinder head cover gasket
   - Cylinder head cover

**NOTE:**

- Apply Gasket Maker® onto the mating surfaces of the cylinder head cover gasket and cylinder head.
- Tighten the cylinder head cover bolts stages and in a crisscross pattern.

| | |
|---|---|
| T.R. | **Cylinder head cover bolt:**<br>**12 N • m (1.2 kgf • m, 8.7 ft • lb)** |

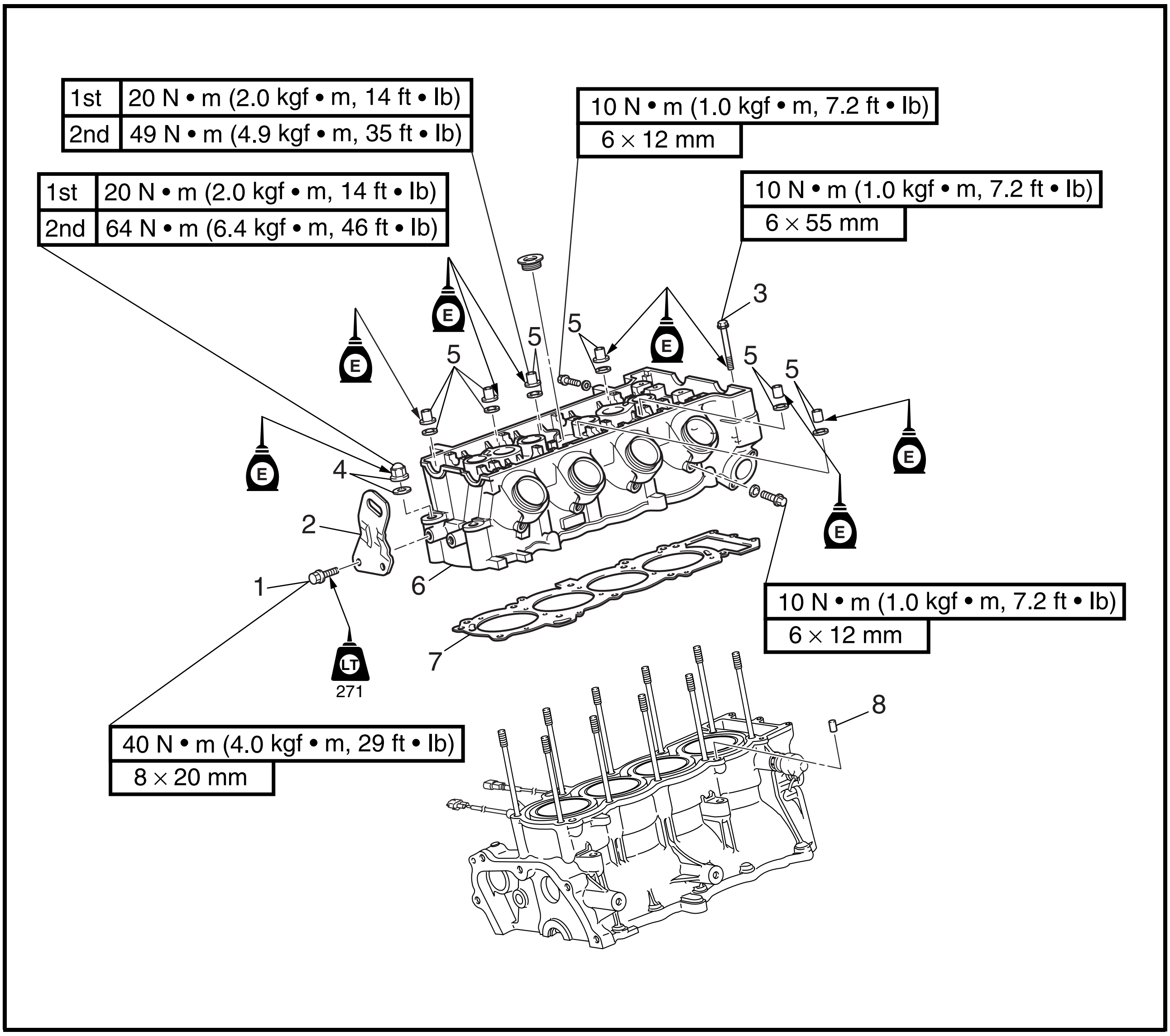
# CYLINDER HEAD
## EXPLODED DIAGRAM



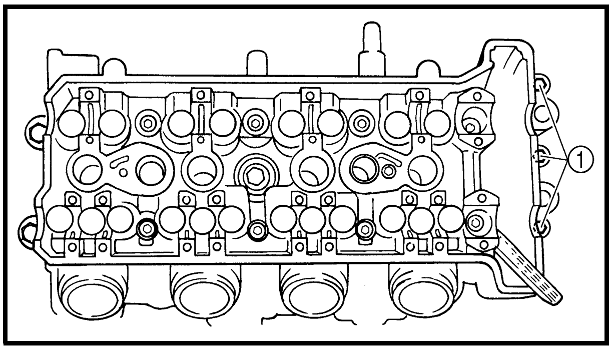

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CYLINDER HEAD REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT". |
| | Air filter case | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| | Exhaust pipe 3 | | Refer to "EXHAUST PIPE 3". |
| | Exhaust pipes 1 and 2 | | Refer to "EXHAUST PIPES 1 AND 2". |
| | Oil tank | | Refer to "OIL TANK". |
| | Intake and exhaust camshaft | | Refer to "CAMSHAFTS". |
| 1 | Bolt | 2 | |
| 2 | Hunger | 1 | |
| 3 | Bolt | 3 | |

## EXPLODED DIAGRAM



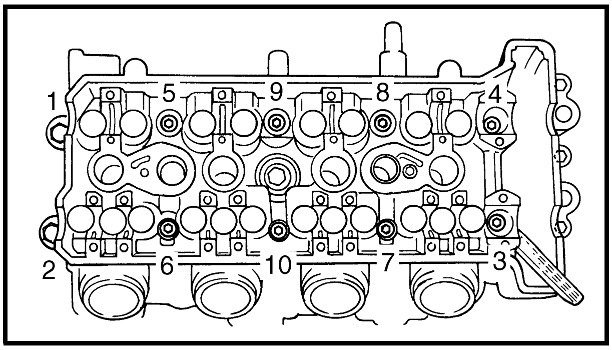

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 4 | Nut/washer | 2/2 | |
| 5 | Nut/washer | 8/8 | |
| 6 | Cylinder head | 1 | |
| 7 | Cylinder head gasket | 1 | **Not reusable** |
| 8 | Dowel pin | 2 | |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS

### Cylinder head removal

1. Remove:
   - Cylinder head bolts ①




2. Remove:
   - Cylinder head nuts

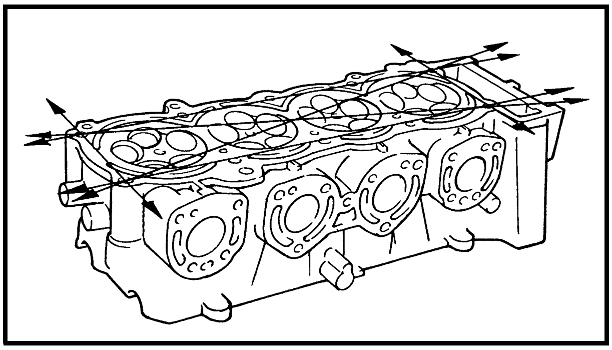
**NOTE:**
Loosen the cylinder head nuts in the sequence shown.

### Cylinder head inspection

1. Eliminate:
   - Combustion chamber carbon deposits (with a rounded scraper)

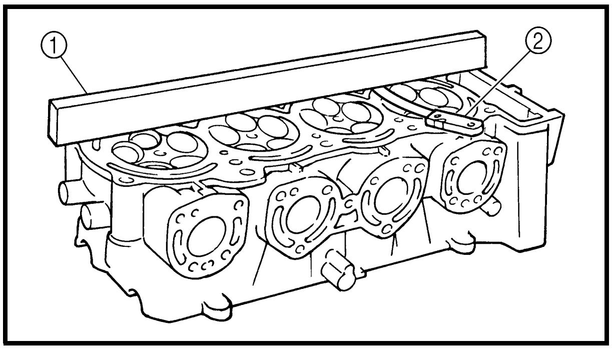
**NOTE:**
Do not use a sharp instrument to avoid damaging or scratching:
- spark plug bore threads
- valve seats

2. Check:
   - Cylinder head
     Damage/scratches → Replace.
   - Cylinder head water jacket
     Mineral deposits/rust → Eliminate.

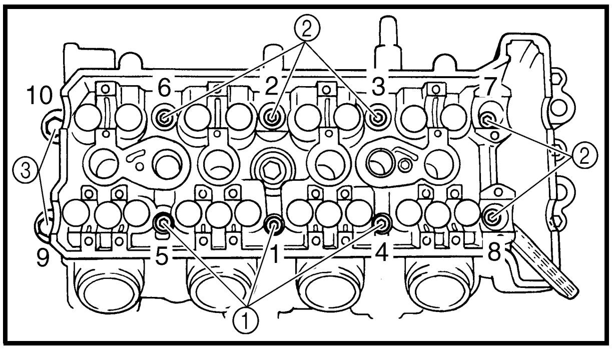


3. Measure:
   - Cylinder head warpage
     Out of specification → Replace the cylinder head.

**Cylinder head warpage limit:**
**0.1 mm (0.004 in)**




**Measurement steps:**
- Place a straightedge ① and a thickness gauge ② across the cylinder head.
- Measure the warpage.
- If the limit is exceeded, replace the cylinder head.

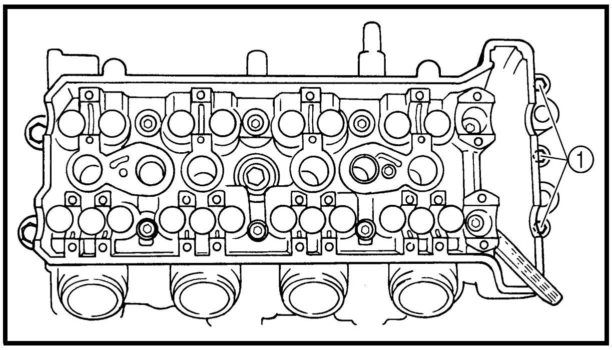



**Cylinder head installation**

1. Install:
   - Cylinder head

**NOTE:**
- Pass the timing chain through the timing chain cavity.
- Lubricate the cylinder head nuts with engine oil.
- Tighten the cylinder head nuts in the sequence shown.

**Cylinder head nut ①, ②:**
**1st:**
**20 N • m (2.0 kgf • m, 14 ft • lb)**
**2nd:**
**49 N • m (4.9 kgf • m, 35 ft • lb)**
**Cylinder head nut ③:**
**1st:**
**20 N • m (2.0 kgf • m, 14 ft • lb)**
**2nd:**
**64 N • m (6.4 kgf • m, 46 ft • lb)**



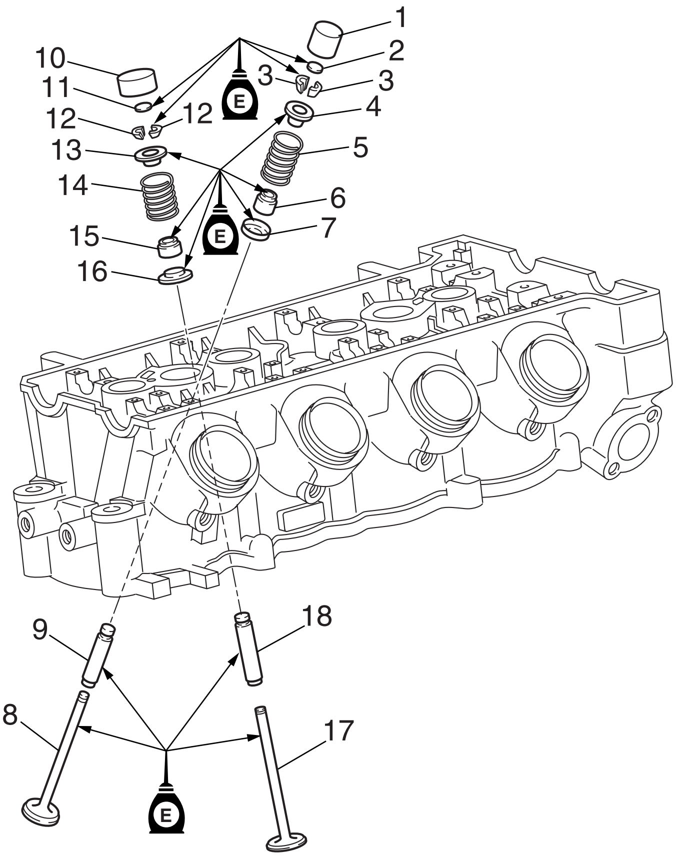

2. Tighten:
   - Cylinder head bolts ①

**NOTE:**
Lubricate the cylinder head bolts with engine oil.

| | |
|---|---|
| | **Cylinder head bolt:** **10 N • m (1.0 kgf • m, 7.2 ft • lb)** |

# VALVES AND VALVE SPRINGS

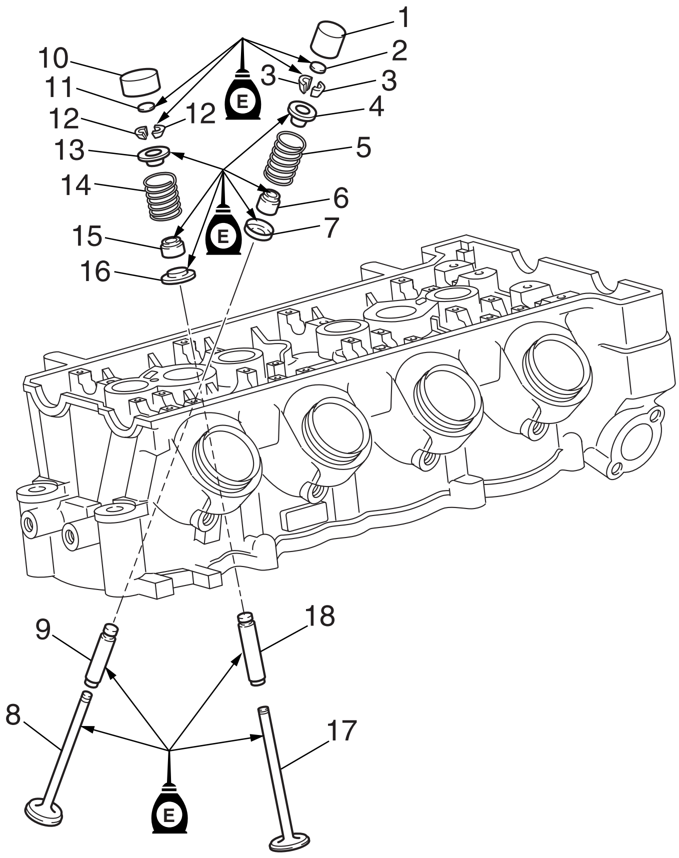
## EXPLODED DIAGRAM



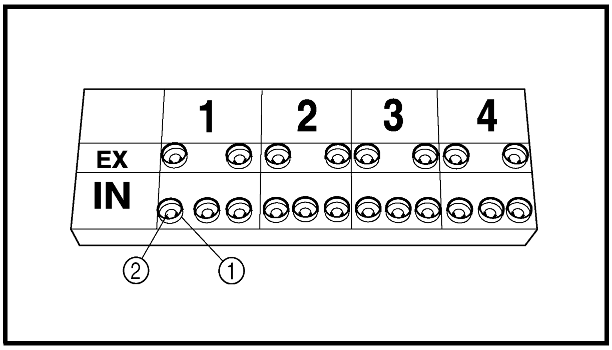

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **VALVES AND VALVE SPRINGS REMOVAL** | | Follow the left "Step" for removal. |
| | Cylinder head | | Refer to "CYLINDER HEAD". |
| 1 | Intake valve lifter | 12 | |
| 2 | Intake valve pad | 12 | |
| 3 | Intake valve cotter | 24 | |
| 4 | Intake valve upper spring seat | 12 | |
| 5 | Intake valve spring | 12 | |
| 6 | Intake valve oil seal | 12 | |
| 7 | Intake valve lower spring seat | 12 | |
| 8 | Intake valve | 12 | |
| 9 | Intake valve guide | 12 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 10 | Exhaust valve lifter | 8 | |
| 11 | Exhaust valve pad | 8 | |
| 12 | Exhaust valve cotter | 16 | |
| 13 | Exhaust valve upper spring seat | 8 | |
| 14 | Exhaust valve spring | 8 | |
| 15 | Exhaust valve oil seal | 8 | |
| 16 | Exhaust valve lower spring seat | 8 | |
| 17 | Exhaust valve | 8 | |
| 18 | Exhaust valve guide | 8 | |
| | | | Reverse the removal steps for installation. |

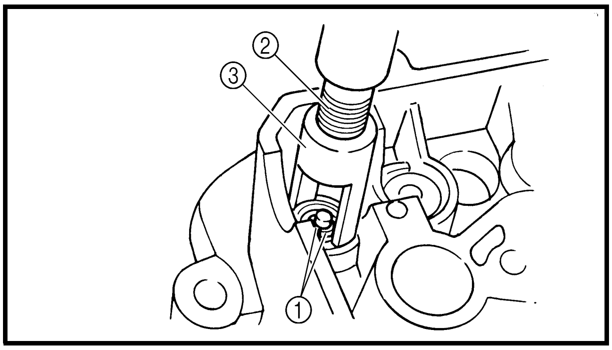



## SERVICE POINTS

### Valve removal

1. Remove:
   - Valve lifter ①
   - Valve pad ②

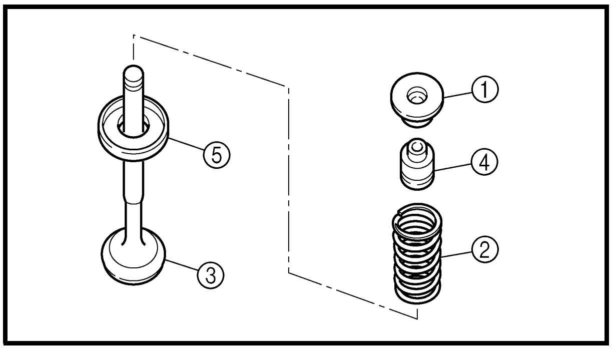
**NOTE:**
Make a note of the position of each valve lifter and valve pad so that they can be reinstalled in their original place.




2. Remove:
   - Valve cotters ①

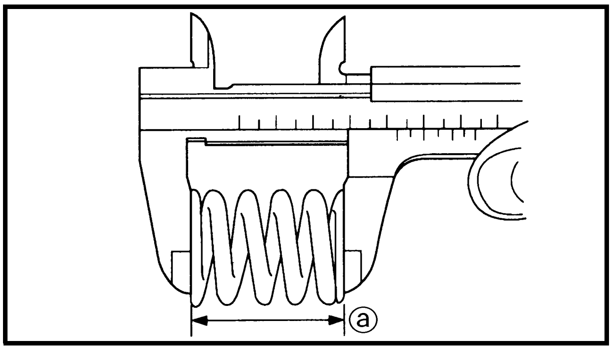
**NOTE:**
Remove the valve cotters by compressing the valve spring with the valve spring compressor ② and attachment ③.

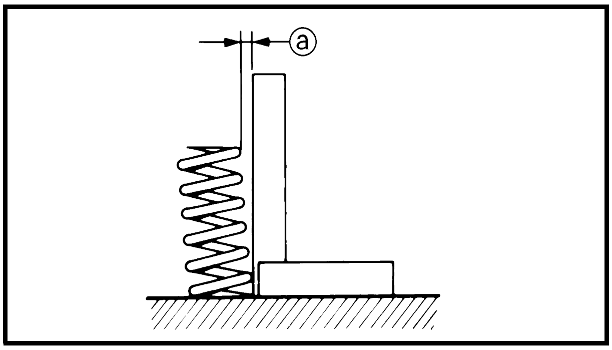
**Valve spring compressor:**
**YM-04019/90890-04019**
**Valve spring compressor attachment:**
**(for the intake valve)**
**YM-4114/90890-04114**
**(for the exhaust valve)**
**YM-4108/90890-04108**




3. Remove:
   - Upper spring seat ①
   - Valve spring ②
   - Valve ③
   - Oil seal ④
   - Lower spring seat ⑤

**NOTE:**
Identify the position of each part very carefully so that it can be reinstalled in its original place.




**Valve spring inspection**

1. Measure:
   - Valve spring free length ⓐ
     Out of specification → Replace the valve spring.

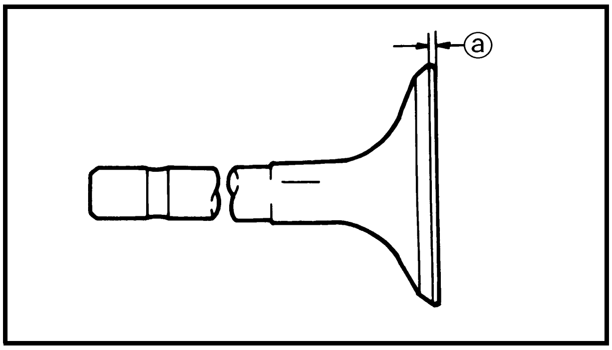
| | |
|---|---|
| | **Valve spring free length:**<br>**Intake valve spring:**<br>**38.90 mm (1.53 in)**<br>**Exhaust valve spring:**<br>**40.67 mm (1.60 in)** |

2. Measure:
   - Valve spring tilt ⓐ
     Out of specification → Replace the valve spring.

| | |
|---|---|
| | **Valve spring tilt:**<br>**Intake valve spring:**<br>**1.7 mm (0.067 in)**<br>**Exhaust valve spring:**<br>**1.8 mm (0.071 in)** |

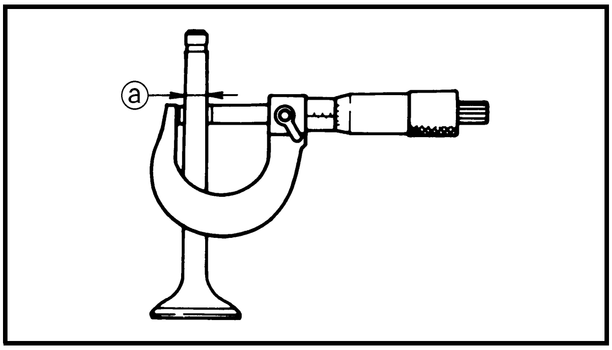
**Valve inspection**

1. Eliminate:
   - Carbon deposits
     (from the valve face and valve seat)
2. Check:
   - Valve face
     Pitting/wear → Replace the valve.



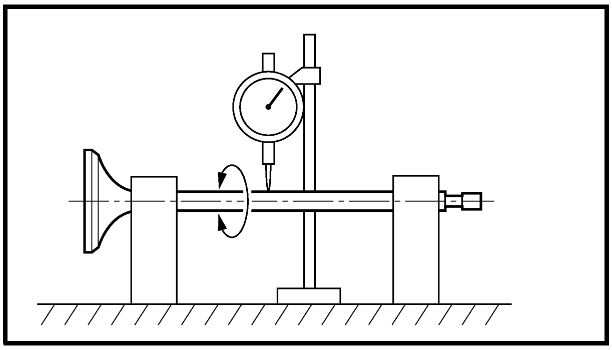

3. Measure:
   - Valve margin thickness ⓐ
     Out of specification → Replace the valve.

| | |
|---|---|
| | **Valve margin thickness:**<br>**0.5–0.9 mm (0.0197–0.0354 in)** |




4. Measure:
   - Valve stem diameter ⓐ
     Out of specification → Replace the valve.

**Valve stem diameter ⓐ:**
**Intake valve:**
**3.975–3.990 mm**
**(0.1565–0.1571 in)**
**Exhaust valve:**
**4.460–4.475 mm**
**(0.1756–0.1762 in)**



5. Measure:
   - Valve stem runout
     Out of specification → Replace the valve.

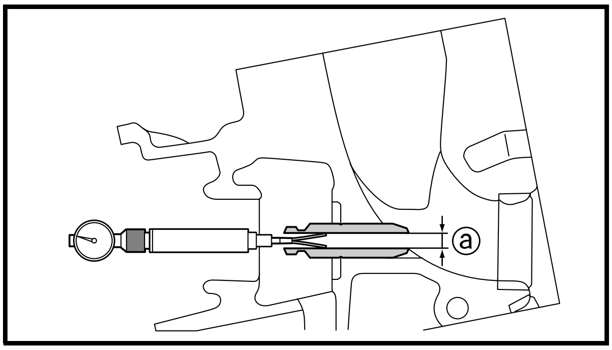
**NOTE:**

- When installing a new valve, always replace the valve guide.
- If the valve is removed or replaced, always replace the oil seal.

**Valve stem runout:**
**0.01 mm (0.0004 in)**

**Valve guide inspection**

**NOTE:**
Before checking the valve guide make sure that the valve stem diameter is within specification.

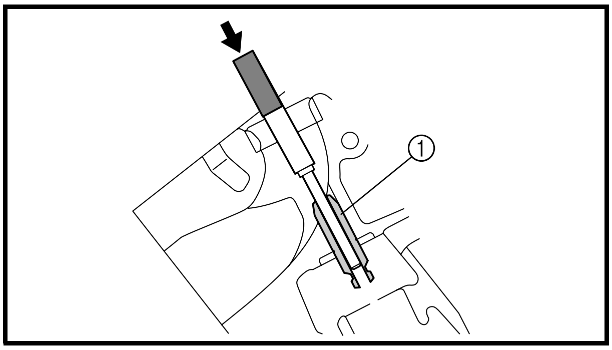



1. Measure:
   - Valve guide inside diameter ⓐ

**Valve guide inside diameter:**
**Intake:**
**4.000–4.012 mm**
**(0.1575–0.1580 in)**
**Exhaust:**
**4.500–4.512 mm**
**(0.1772–0.1776 in)**

2. Calculate the valve stem-to-valve guide clearance as follows. Replace the valve guide if out of specification.

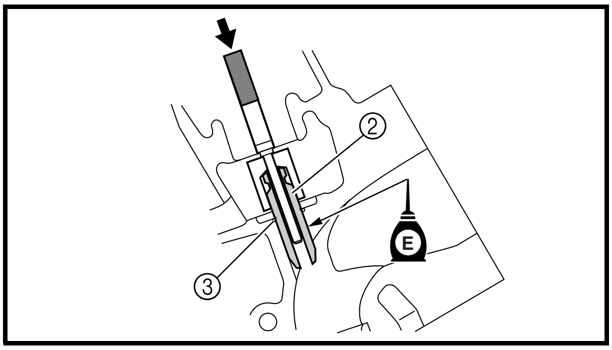
**Valve stem-to-valve guide clearance = valve guide inside diameter – valve stem diameter:**
**Intake:**
**0.010–0.037 mm**
**(0.0004–0.0015 in)**
**Exhaust:**
**0.025–0.052 mm**
**(0.0010–0.0020 in)**




**Valve guide replacement**

1. Remove the valve guide ① by striking the special service tool from the combustion chamber side.

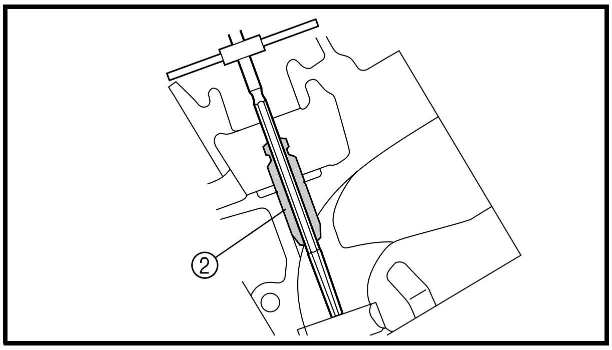
**Valve guide remover:**
**Intake (4.0 mm):**
**YM-04111/90890-04111**
**Exhaust (4.5 mm):**
**YM-04116/90890-04116**




2. Install the new valve guide ② by striking the special service tool from the camshaft side until the valve guide clip ③ contacts the cylinder head.

**NOTE:**
Apply engine oil to the surface of the new valve guide.

**Valve guide remover:**
**Intake (4.0 mm):**
**YM-04111/90890-04111**
**Exhaust (4.5 mm):**
**YM-04116/90890-04116**
**Valve guide installer:**
**Intake (4.0 mm):**
**YM-04112/90890-04112**
**Exhaust (4.5 mm):**
**YM-04117/90890-04117**




3. Insert the special service tool into the valve guide ②, and then ream the valve guide.

**NOTE:**
- Turn the valve guide reamer clockwise to ream the valve guide.
- Do not turn the reamer counterclockwise when removing the reamer.

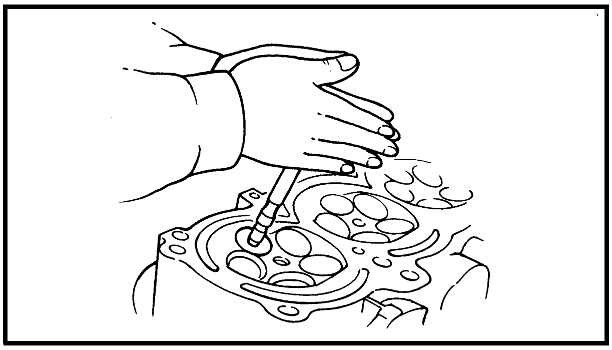
**Valve guide reamer:**
**Intake (4.0 mm):**
**YM-04113/90890-04113**
**Exhaust (4.5 mm):**
**YM-04118/90890-04118**

4. Measure:
   - Valve guide inside diameter

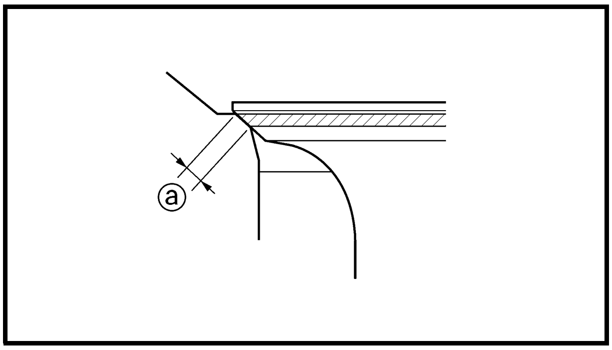
**Valve guide inside diameter:**
**Intake:**
**4.000–4.012 mm**
**(0.1575–0.1580 in)**
**Exhaust:**
**4.500–4.512 mm**
**(0.1772–0.1776 in)**

**Valve seat inspection**

1. Eliminate carbon deposits from the valve with a scraper.
2. Apply a thin, even layer of Mechanic’s blueing dye (Dykem) onto the valve seat.

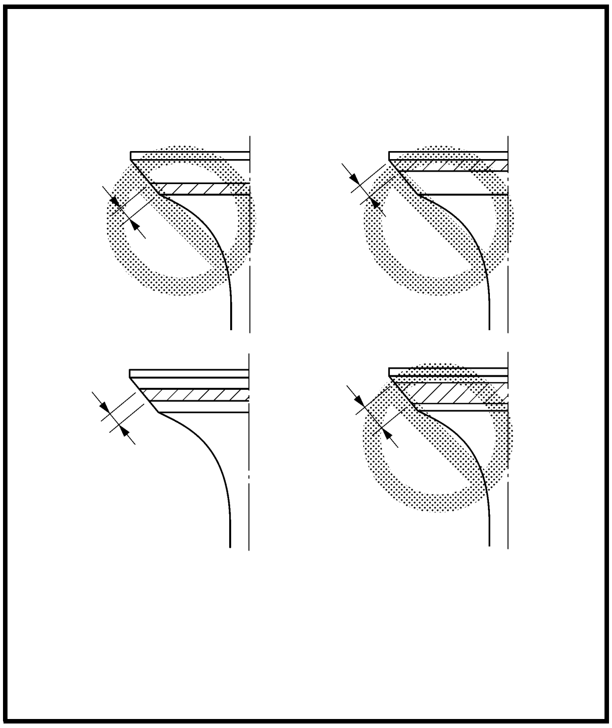


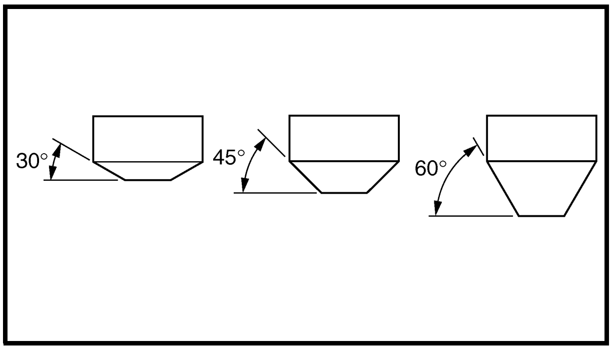
3. Lap the valve slowly on the valve seat with a valve lapper (commercially obtainable) as shown.




4. Measure the valve seat contact width ⓐ where the blueing dye is adhered to the valve face. Reface the valve seat if the valve is not seated properly or if the valve seat contact width is out of specification. Replace the valve guide if the valve seat contact is uneven.

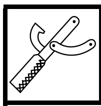
| | |
|---|---|
| | **Valve seat contact width ⓐ:**<br>**0.9–1.1 mm (0.0354–0.0433 in)** |



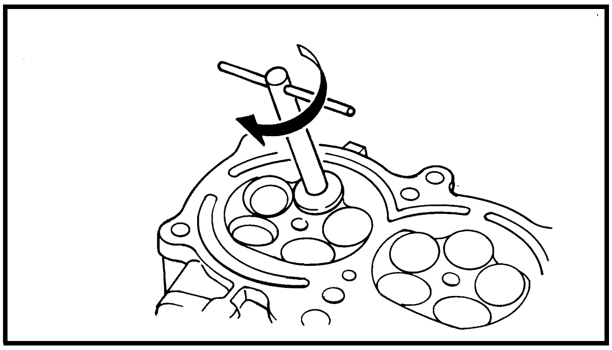



**Valve seat reface**

1. Reface the valve seat with the valve seat cutter.

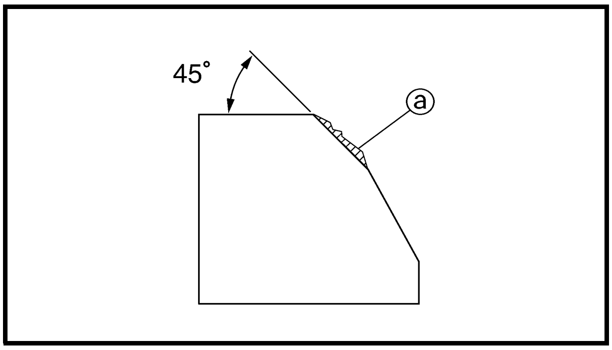


**Valve seat cutter holder:**
**Intake (4.0 mm):**
**90890-06811**
**Exhaust (4.5 mm):**
**90890-06812**
**Valve seat cutter:**
**30° (intake):**
**90890-06815**
**45° (intake):**
**90890-06814**
**60° (intake):**
**90890-06813**
**30° (exhaust):**
**90890-06328**
**45° (exhaust):**
**90890-06312**
**60° (exhaust):**
**90890-06315**
**Valve seat cutter set:**
**YM-91043-C**



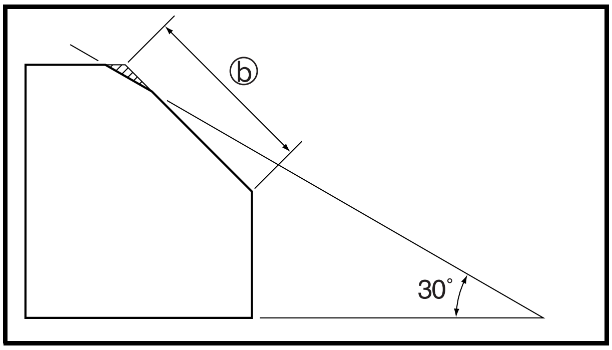
2. Cut the surface of the valve seat with a 45° cutter by turning the cutter clockwise until the valve seat face has become smooth.

ⓐ Slag or rough surface



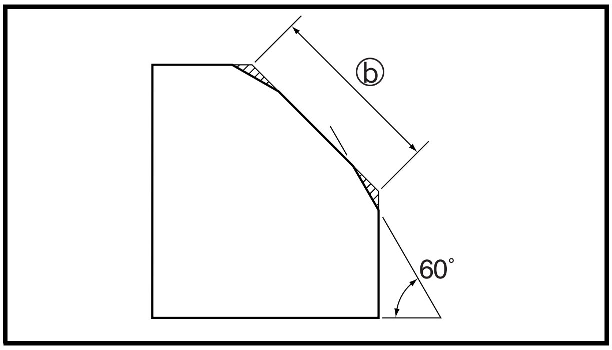

**CAUTION:**

**Do not over cut the valve seat. Be sure to turn the cutter evenly downward at a pressure of 40–50 N (4–5 kgf, 8.8–11 lbf) to prevent chatter marks.**



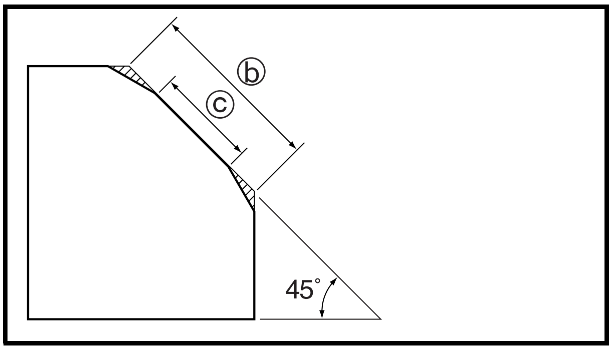

3. Use a 30° cutter to adjust the contact width of the top edge of the valve seat.

ⓑ Previous contact width



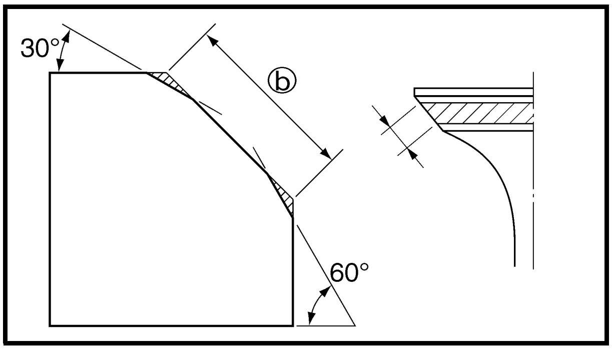

4. Use a 60° cutter to adjust the contact width of the bottom edge of the valve seat.

ⓑ Previous contact width



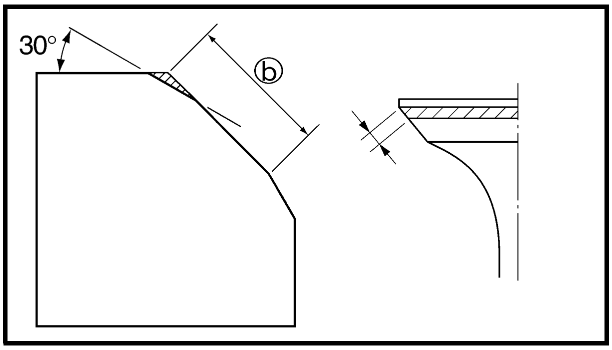

5. Use a 45° cutter to adjust the contact width of the valve seat to specification.

ⓑ Previous contact width
ⓒ Specified contact width



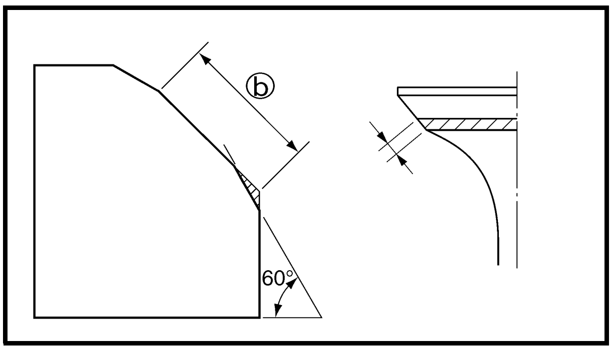

6. If the valve seat contact area is too wide and situated in the center of the valve face, use a 30° cutter to cut the top edge of the valve seat, a 60° cutter to cut the bottom edge to center the area and set its width.

ⓑ Previous contact width



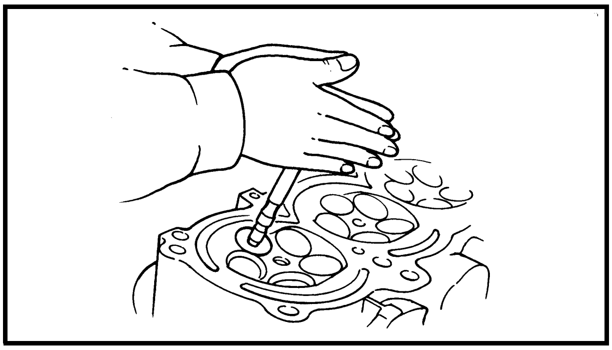

7. If the valve seat contact area is too narrow and situated near the top edge of the valve face, use a 30° cutter to cut the top edge of the valve seat. If necessary, use a 45° cutter to center the area and set its width.

ⓑ Previous contact width




8. If the valve seat contact area is too narrow and situated near the bottom edge of the valve face, use a 60° cutter to cut the bottom edge of the valve seat. If necessary, use a 45° cutter to center the area and set its width.

ⓑ Previous contact width

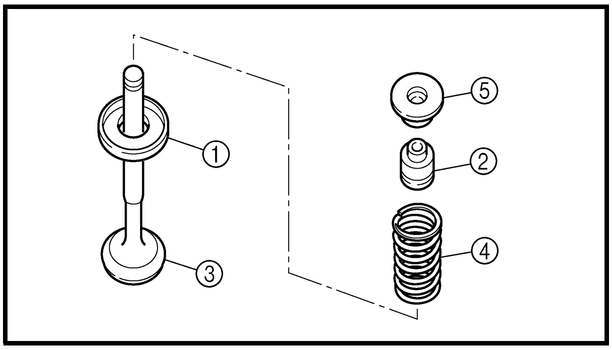


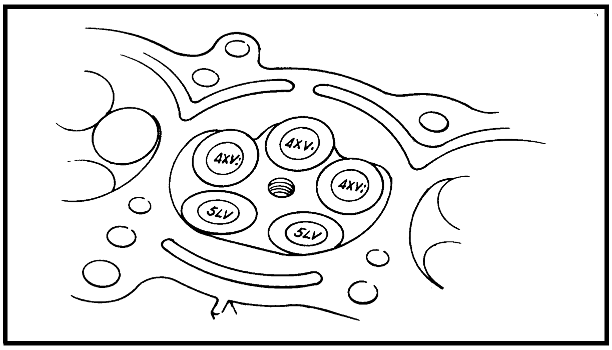
9. Apply a thin, even layer of lapping compound onto the valve seat, and then lap the valve using a valve lapper (commercially obtainable).

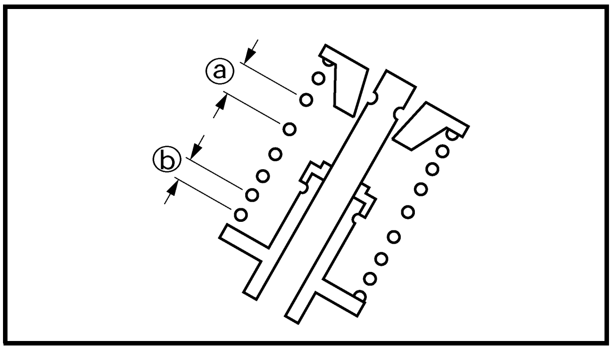
**CAUTION:**

**Do not get the lapping compound on the valve stem and valve guide.**

10. After every lapping procedure, be sure to clean off any remaining lapping compound from the cylinder head and the valve.
11. Check the valve seat contact area of the valve again.



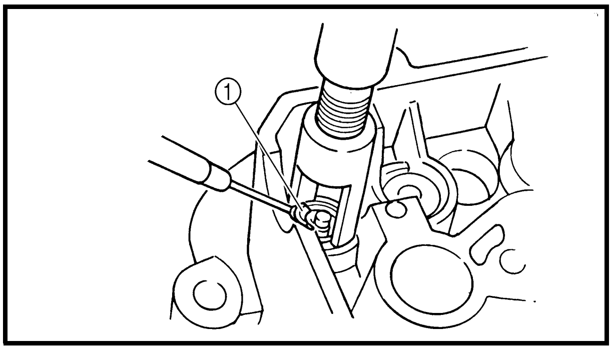

**Valve installation**

1. Install:
   - Lower spring seat ①
   - Oil seal ②
   - Valve ③
   - Valve spring ④
   - Upper spring seat ⑤
     (into the cylinder head)

**NOTE:**

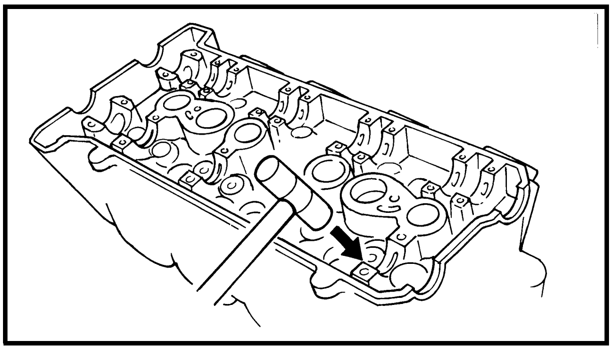
- Make sure that each valve is installed in its original place. Refer to the following embossed marks.
  Right and left intake valve(-s): “4XV:”
  Middle intake valve(-s): “4XV.”
  Exhaust valve(-s): “5LV”
- Install the valve spring with the larger pitch ⓐ facing up.

ⓑ Smaller pitch




2. Compress the valve spring, and then install the valve cotter ① using a thin screwdriver with a small amount of grease applied to it.

**Valve spring compressor:**
**YM-04019/90890-04019**
**Valve spring compressor attachment:**
**(for the intake valve)**
**YM-4114/90890-04114**
**(for the exhaust valve)**
**YM-4108/90890-04108**

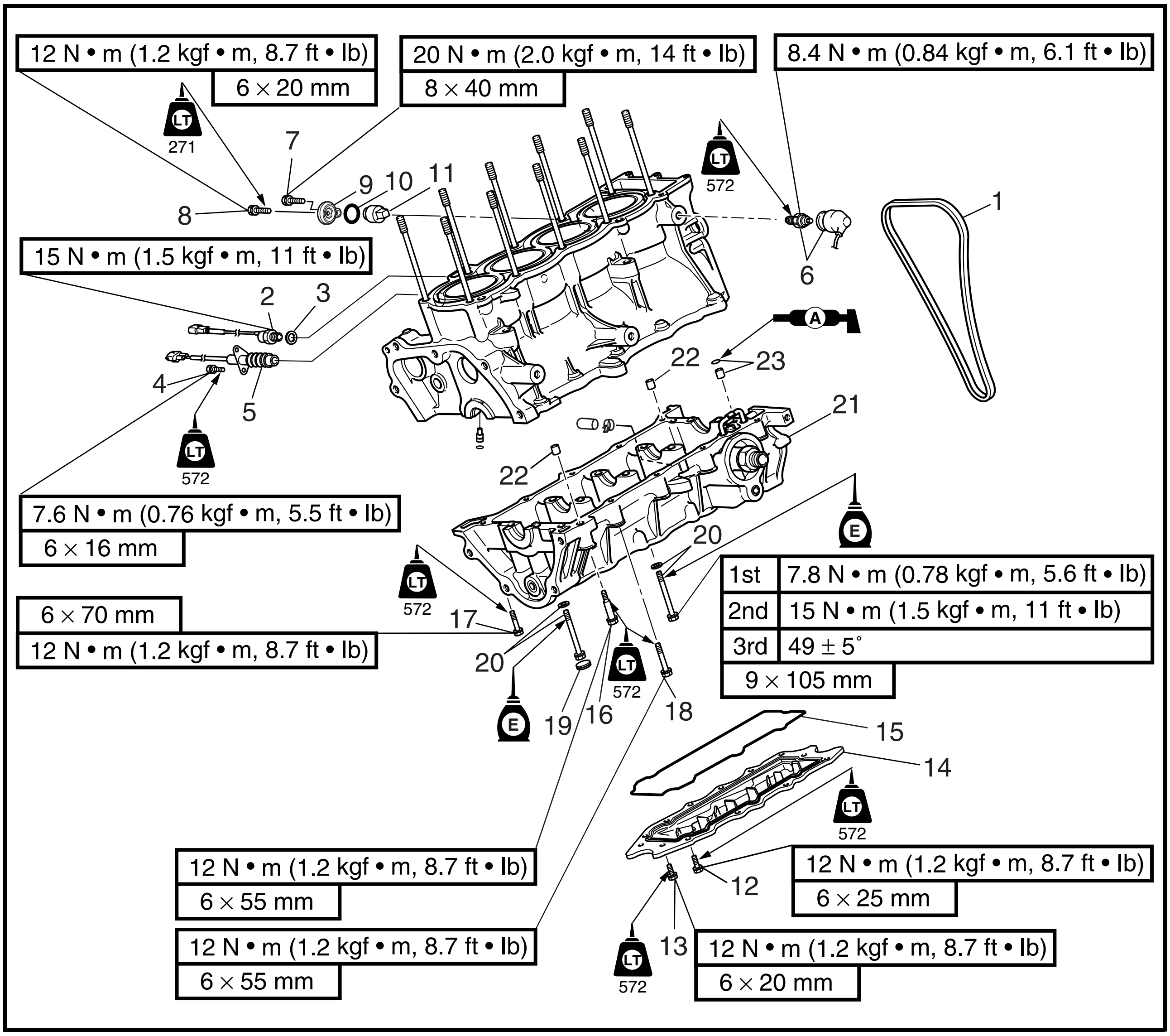


3. Lightly tap the valve spring retainer with a plastic hammer to set the valve cotter securely.

**NOTE:**
Apply engine oil to the valve shims and valve lifters before installation.

# CRANKCASE

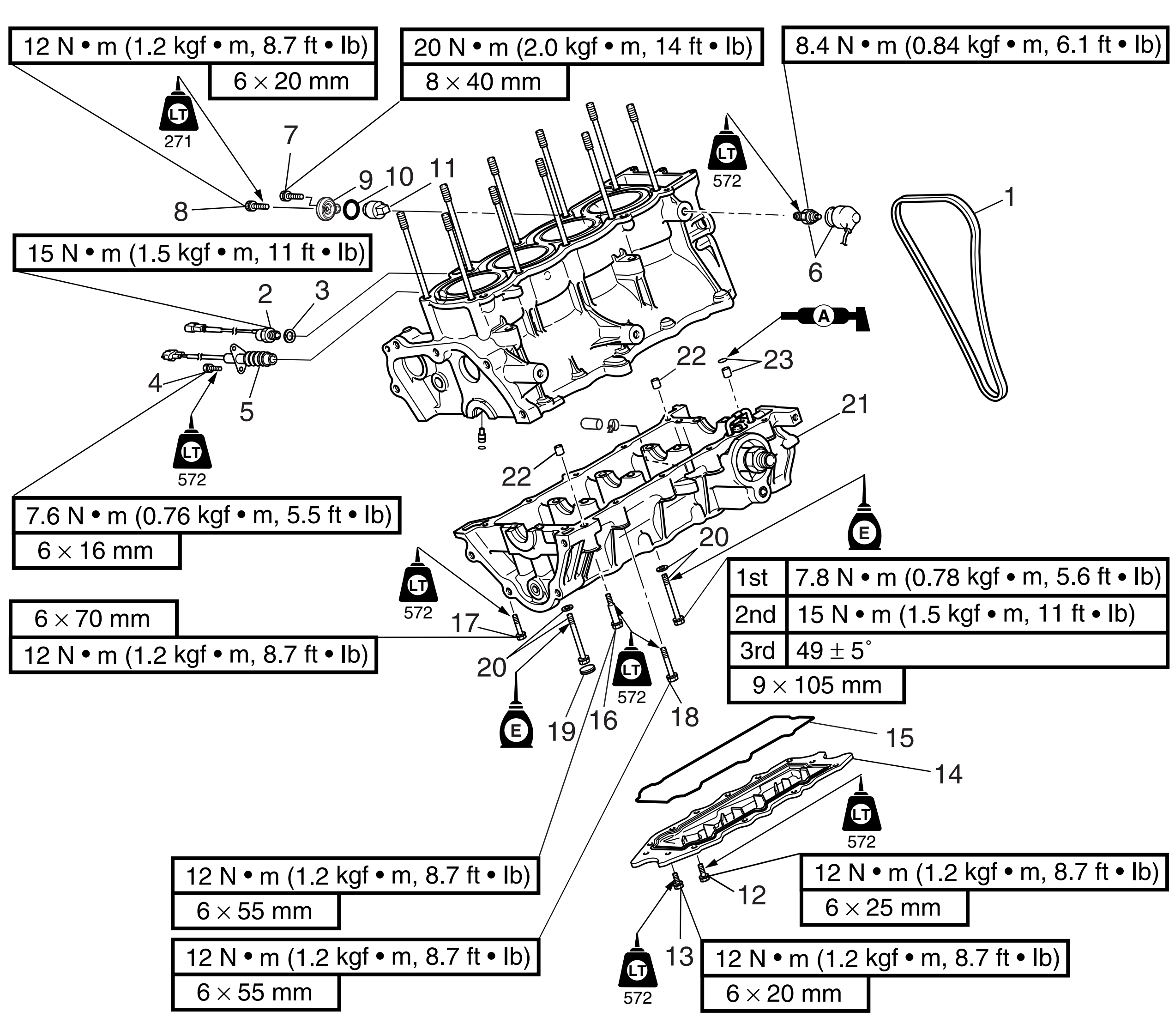
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

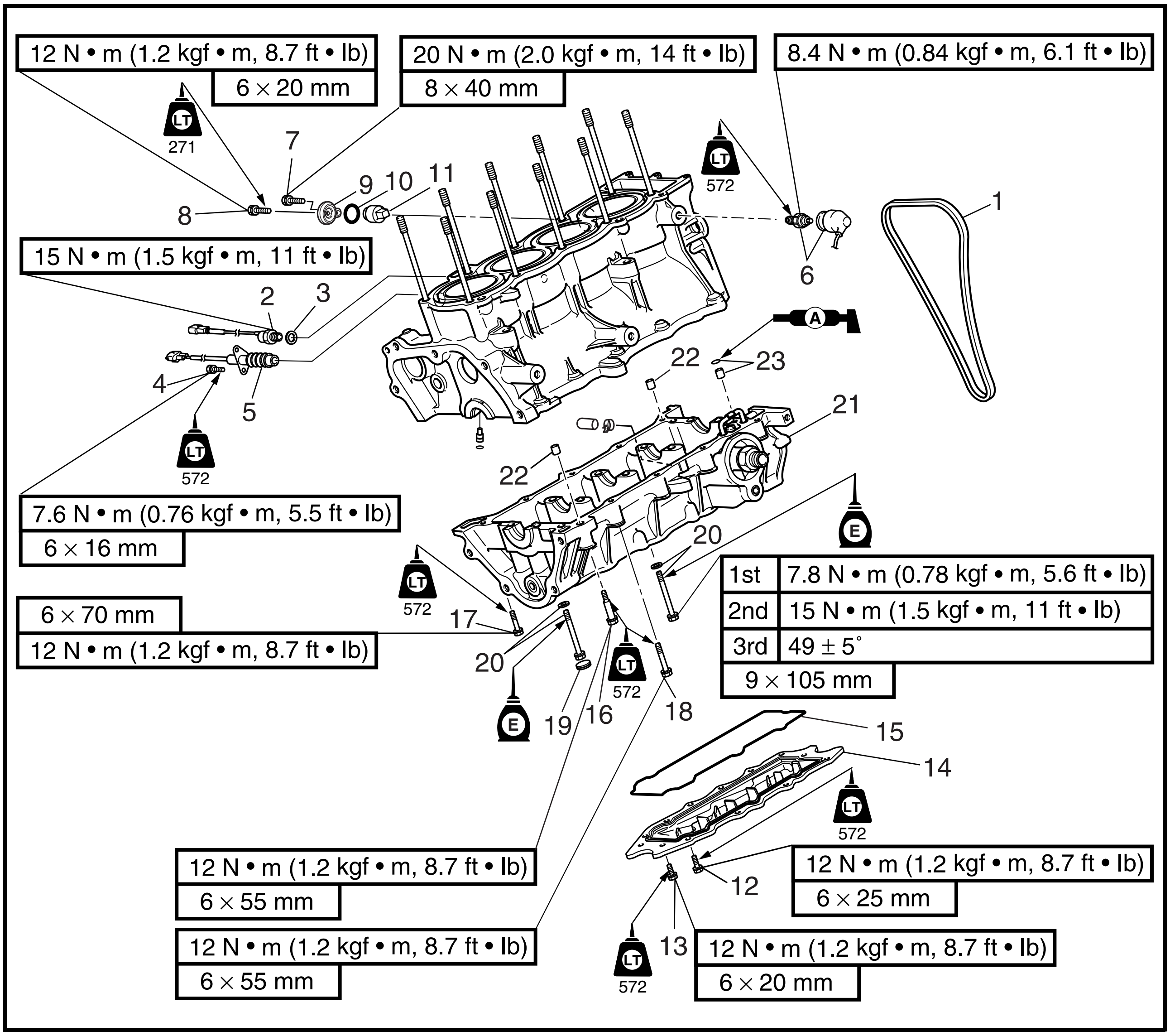
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL PAN AND CRANKCASE REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT". |
| | Air filter case | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| | Exhaust pipe 3 | | Refer to "EXHAUST PIPE 3". |
| | Exhaust pipes 1 and 2 | | Refer to "EXHAUST PIPES 1 AND 2". |
| | Exhaust manifold | | Refer to "EXHAUST MANIFOLD". |
| | Generator cover | | Refer to "GENERATOR AND STARTER MOTOR". |
| | Oil tank | | Refer to "OIL TANK". |

## EXPLODED DIAGRAM



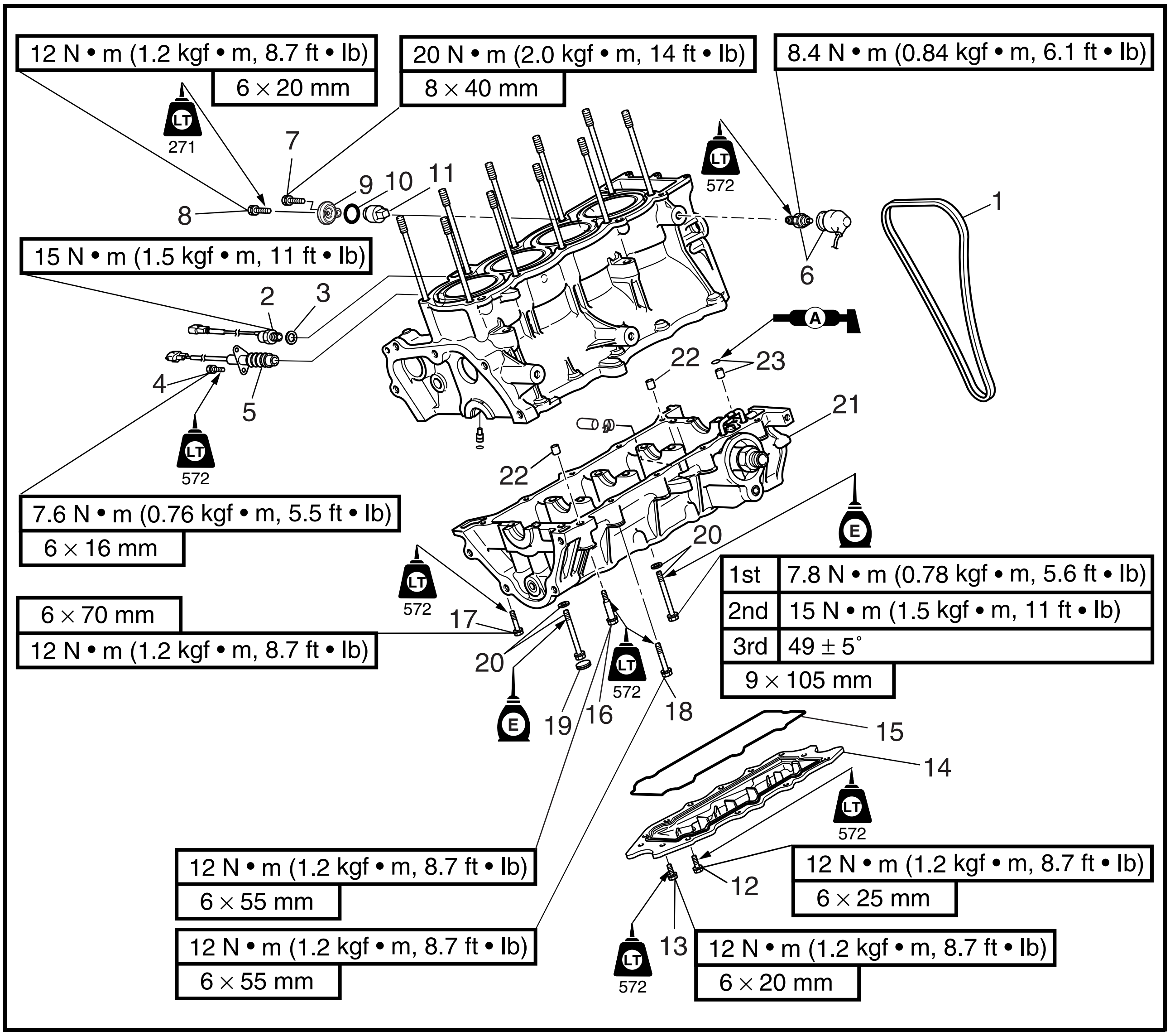

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | Oil pump | | Refer to "OIL PUMP". |
| | Reduction drive gear case | | Refer to "REDUCTION DRIVE GEAR". |
| | Cylinder head | | Refer to "CAMSHAFTS". |
| 1 | Timing chain | 1 | |
| 2 | Engine temperature sensor | 1 | |
| 3 | Washer | 1 | |
| 4 | Bolt | 2 | |
| 5 | Thermoswitch (engine) | 1 | |
| 6 | Oil pressure switch | 1 | |
| 7 | Bolt | 1 | |

## EXPLODED DIAGRAM



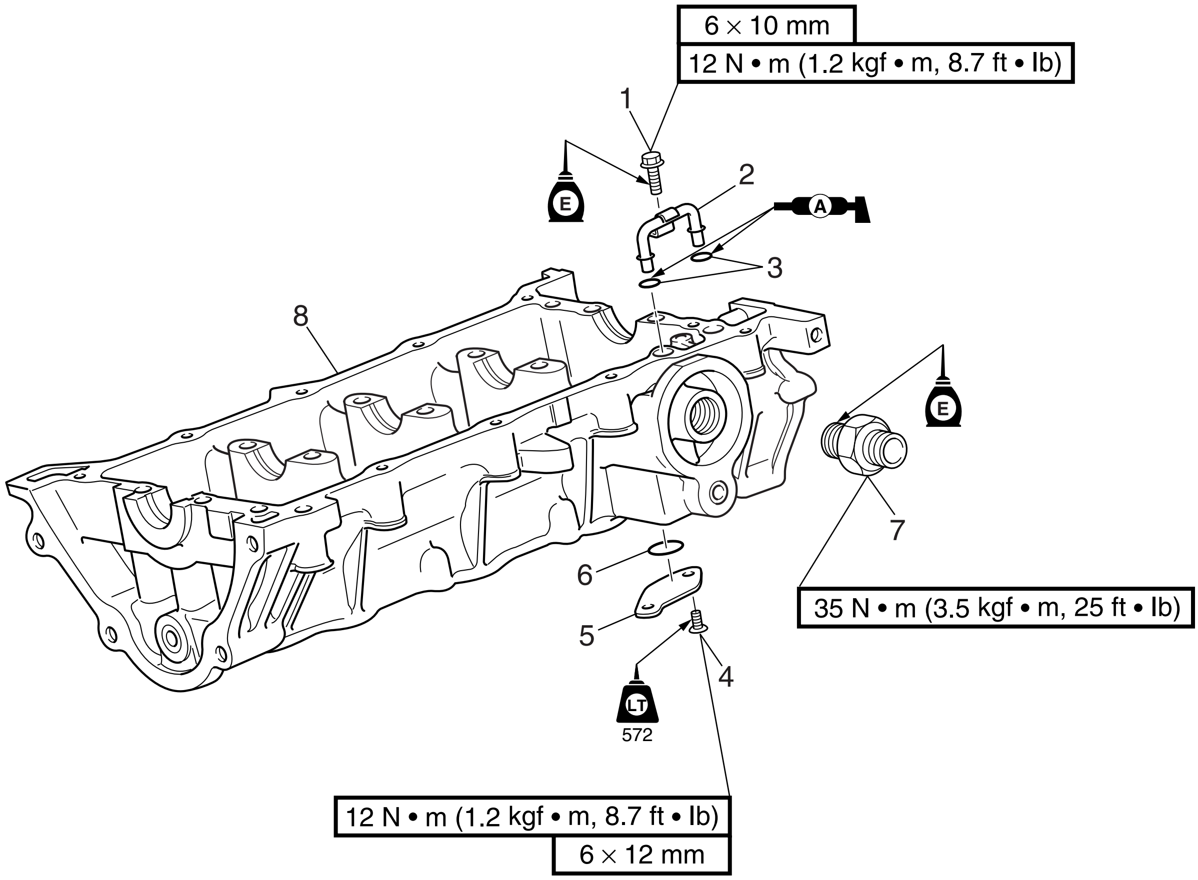

| Step | Procedure/Part name | Q’ty | Service points |
|---|---|---|---|
| 8 | Bolt | 1 | |
| 9 | Anode cover | 1 | |
| 10 | Grommet | 1 | |
| 11 | Anode | 1 | |
| 12 | Bolt | 4 | |
| 13 | Bolt | 9 | |
| 14 | Oil pan | 1 | |
| 15 | Gasket | 1 | Not reusable |
| 16 | Bolt | 2 | |
| 17 | Bolt | 1 | |
| 18 | Bolt | 7 | |

## EXPLODED DIAGRAM



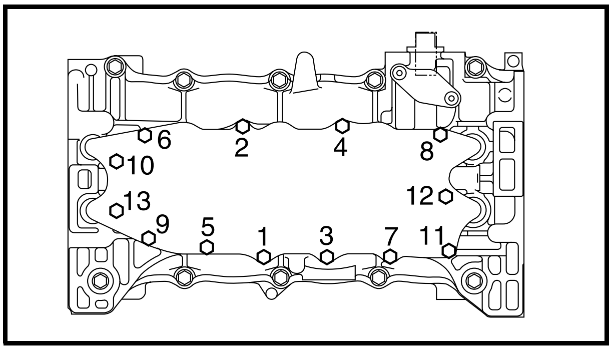

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 19 | Cap | 4 | |
| 20 | Bolt/washer | 10/10 | |
| 21 | Lower crankcase | 1 | |
| 22 | Dowel pin | 2 | |
| 23 | Dowel pin/O-ring | 1/1 | **Not reusable** |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL PIPE AND OIL FILTER BOLT REMOVAL** | | Follow the left "Step" for removal. |
| | Crankshaft | | Refer to "CRANKSHAFT". |
| 1 | Bolt | 1 | |
| 2 | Oil pipe | 1 | |
| 3 | O-ring | 2 | Not reusable |
| 4 | Screw | 2 | |
| 5 | Cover | 1 | |
| 6 | O-ring | 1 | Not reusable |
| 7 | Oil filter bolt | 1 | |
| 8 | Lower crankcase | 1 | |
| | | | Reverse the removal steps for installation. |

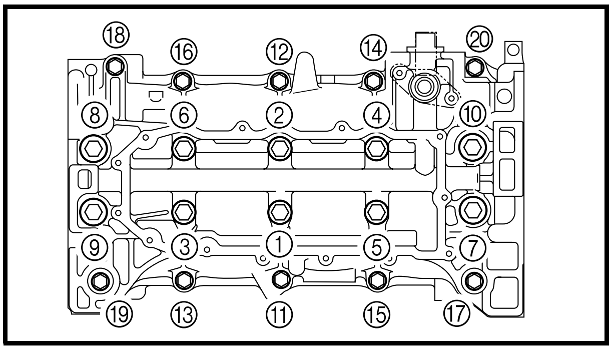



## SERVICE POINTS

**Crankcase disassembly**

1. Remove:
   - Oil pan bolts

**NOTE:**
- Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.
- Loosen the bolts in decreasing numerical order (refer to the numbers in the illustration).
- The numbers embossed on the oil pan indicate the oil pan tightening sequence.




2. Remove:
   - Crankcase bolts

**NOTE:**
- Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.
- Loosen the bolts in decreasing numerical order (refer to the numbers in the illustration).
- The numbers embossed on the crankcase indicate the crankcase tightening sequence.

3. Remove:
   - Lower crankcase

**CAUTION:**

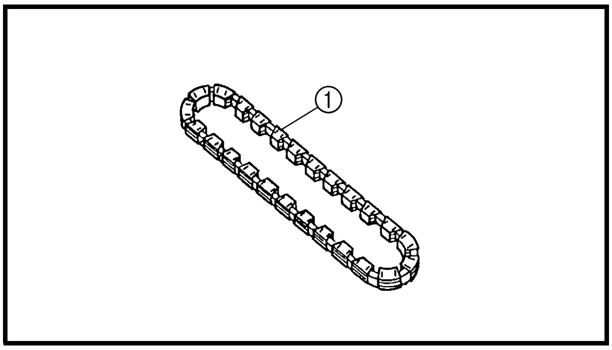
**Tap on one side of the crankcase with a soft-face hammer. Tap only on reinforced portions of the crankcase, not on he crankcase mating surfaces. Work slowly and carefully and make sure the crankcase halves separate evenly.**

M9 × 105 mm bolts: ①–⑩
M6 × 55 mm bolts: ⑪–⑯
M6 × 55 mm bolts: ⑰, ⑱
M6 × 70 mm bolts: ⑲
M6 × 55 mm bolts: ⑳

4. Remove:
   - Dowel pins

**Crankcase inspection**

1. Thoroughly wash the crankcase halves in a mild solvent.
2. Thoroughly clean all the gasket surfaces and crankcase mating surfaces.
3. Check:
   - Crankcase
     Cracks/damage → Replace.
   - Oil delivery passages
     Obstruction → Blow out with compressed air.



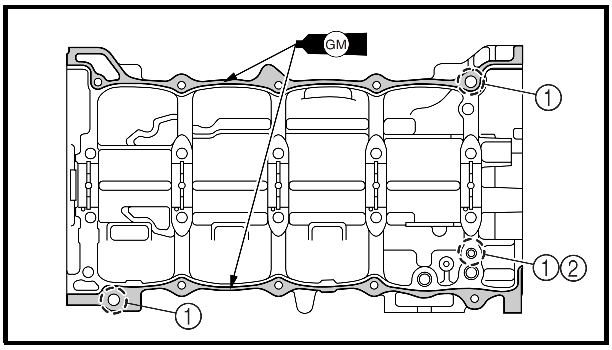

**Timing chain inspection**

1. Check:
   - Timing chain ①
     Damage/stiffness → Replace the timing chain and camshaft sprockets as a set.

**Crankcase assembly**

1. Lubricate:
   Crankshaft journal bearings
   (with the recommended lubricant)

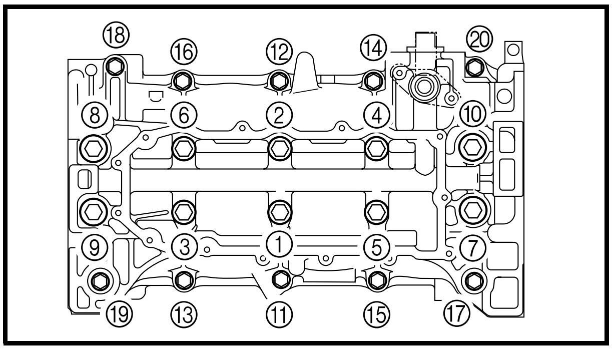
| | |
|---|---|
| | **Recommended lubricant:**<br>**Engine oil** |




2. Apply:
   - Gasket Maker®
     (onto the crankcase mating surfaces)

**NOTE:**
Do not allow any Gasket Maker® to come into contact with the oil gallery or crankshaft journal bearings.

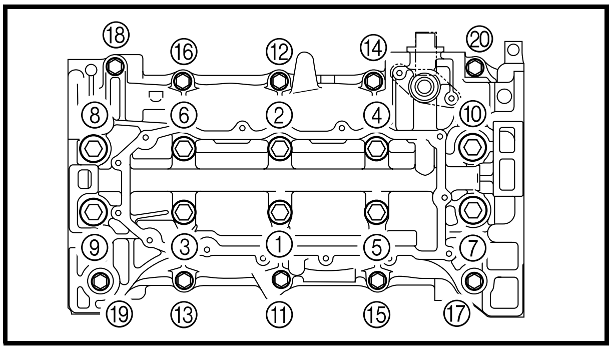
3. Install:
   - Dowel pins ①
   - O-ring ②




4. Install:
   - Crankcase bolts

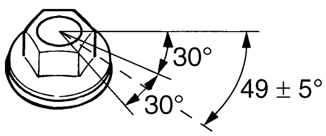
**NOTE:**
- Lubricate the bolt ①–⑩ threads and washers with engine oil.
- Finger tighten the crankcase bolts.

M9 × 105 mm bolts: ①–⑩
M6 × 55 mm bolts: ⑪–⑯
M6 × 55 mm bolts: ⑰, ⑱
M6 × 70 mm bolts: ⑲
M6 × 55 mm bolts: ⑳




5. Tighten:
   - Crankcase bolts ①–⑩

**NOTE:**
- Do not reuse crankcase bolts ①–⑩.
- The tightening procedure of crankcase bolts ①–⑩ is angle controlled, therefore tighten the bolts using the following procedure.




**Tightening steps:**

- Tighten the bolts in the tightening sequence cast on the crankcase.

**Crankcase bolt ①–⑩:**
**1st:**
**7.8 N • m**
**(0.78 kgf • m, 5.6 ft • lb)**

- Loosen and retighten the crankcase bolts in the proper tightening sequence as shown.

**Crankcase bolt ①–⑩:**
**2nd:**
**15 N • m (1.5 kgf • m, 11 ft • lb)**

- Tighten the crankcase bolts further to reach the specified angle 49° in the proper tightening sequence as shown.

**Crankcase bolt ①–⑩:**
**Final:**
**Specified angle 49 ± 5°**

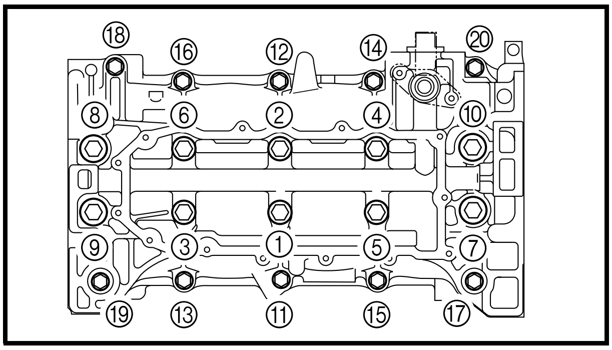
**⚠ WARNING**

**When the bolts are tightened more than the specified angle, do not loosen the bolt and then retighten it.**
**Replace the bolt with a new one and perform the procedure again.**

**CAUTION:**

- **Do not use a torque wrench to tighten the bolt to the specified angle.**
- **Tighten the bolt until it is at the specified angle.**

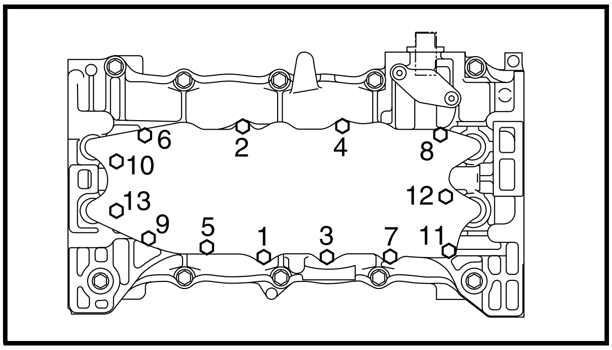
**NOTE:**
When using a hexagonal bolt, note that the angle from one corner to another is 60°.




6. Tighten:
- Crankcase bolts ⑪–⑳

**NOTE:**
Tighten the bolts in the tightening sequence cast on the crankcase.

**Crankcase bolt ⑪–⑳:**
**12 N • m (1.2 kgf • m, 8.7 ft • lb)**

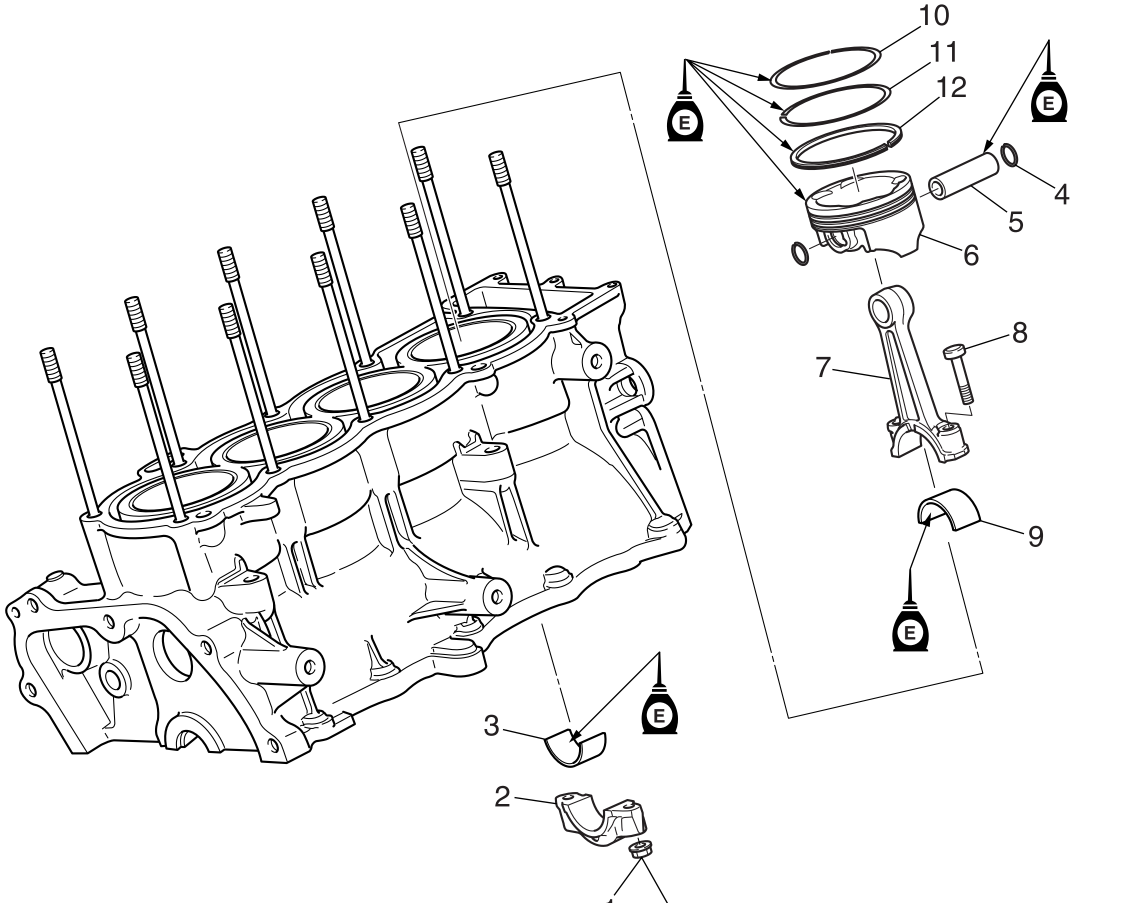



7. Tighten:
- Oil pan bolts

**NOTE:**
Tighten the bolts in the tightening sequence cast on the oil pan.

**Oil pan bolt:**
**12 N • m (1.2 kgf • m, 8.7 ft • lb)**

# CONNECTING RODS AND PISTONS
## EXPLODED DIAGRAM

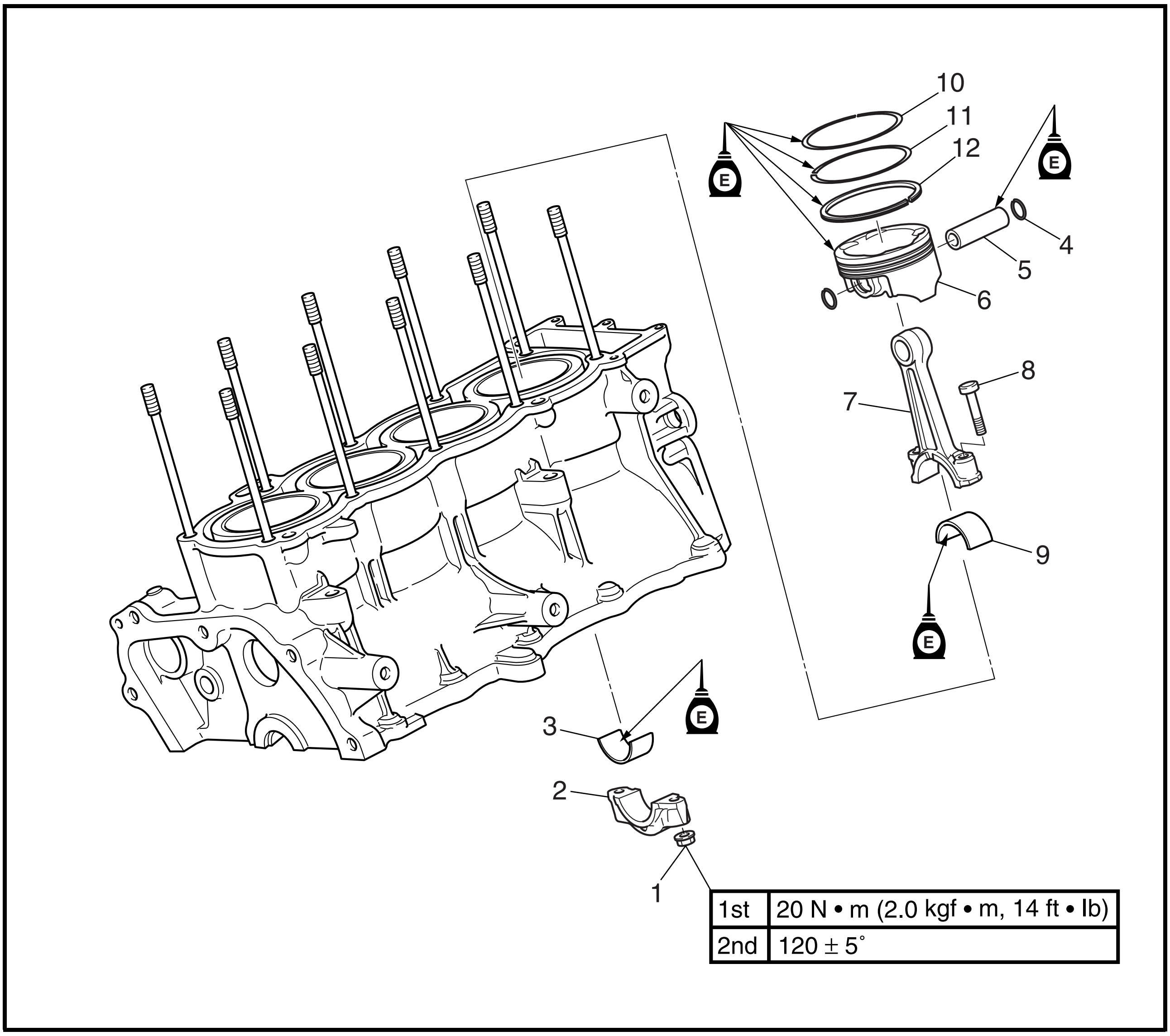



| | |
|---|---|
| 1st | 20 N • m (2.0 kgf • m, 14 ft • lb) |
| 2nd | 120 ± 5˚ |

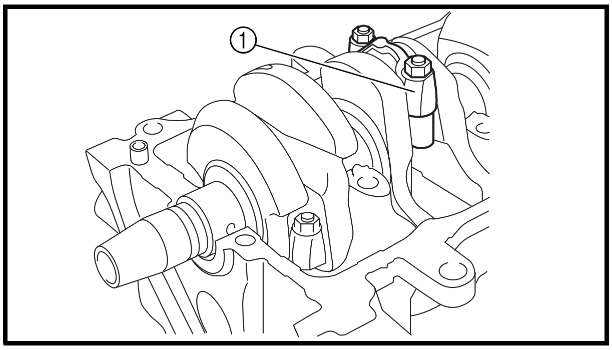
## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CONNECTING RODS AND PISTONS REMOVAL** | | Follow the left "Step" for removal. |
| | Crankcase | | Separate<br>Refer to "CRANKCASE". |
| 1 | Nut | 8 | **Not reusable** |
| 2 | Connecting rod cap | 4 | |
| 3 | Big end lower bearing | 4 | |
| 4 | Piston pin clip | 8 | **Not reusable** |
| 5 | Piston pin | 4 | |
| 6 | Piston | 4 | |
| 7 | Connecting rod | 4 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Bolt | 8 | **Not reusable** |
| 9 | Big end upper bearing | 4 | |
| 10 | Top ring | 4 | |
| 11 | 2nd ring | 4 | |
| 12 | Oil ring | 4 | |
| | | | Reverse the removal steps for installation. |



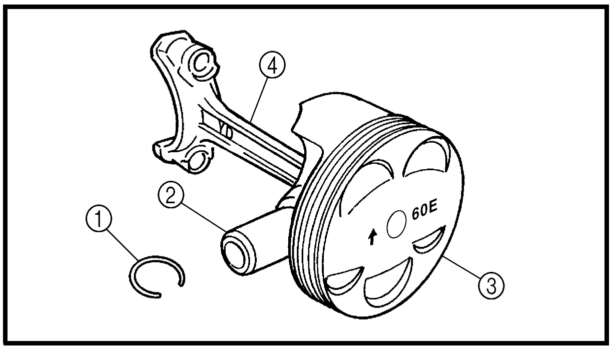

## SERVICE POINTS

### Connecting rod and piston removal

The following procedure applies to all of the connecting rods and pistons.

1. Remove:
   - Connecting rod cap ①
   - Big end bearings

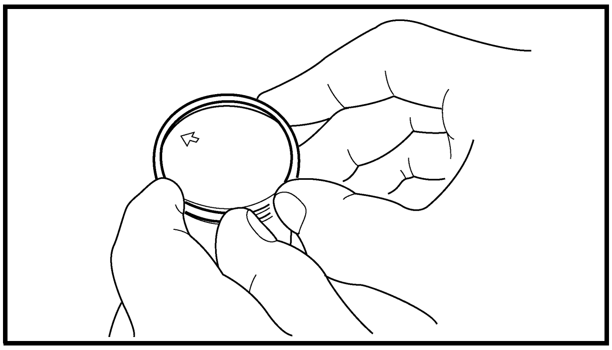
**NOTE:**
Identify the position of each big end bearing so that it can be reinstalled in its original place.




2. Remove:
   - Piston pin clips ①
   - Piston pin ②
   - Piston ③
   - Connecting rod ④

**CAUTION:**
**Do not use a hammer to drive the piston pin out.**

**NOTE:**
- For reference during installation, put identification marks on the piston crown.
- Before removing the piston pin, deburr the piston pin clip's groove and the piston's pin bore area.



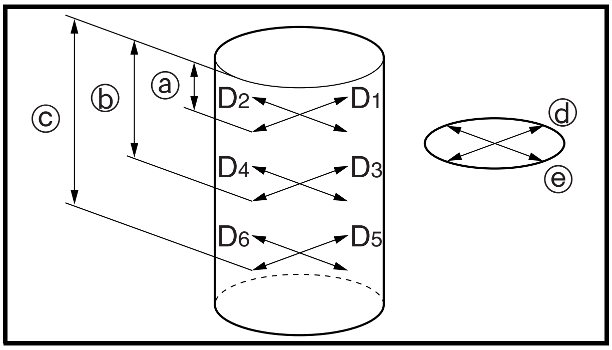
3. Remove:
   - Top ring
   - 2nd ring
   - Oil ring

**NOTE:**
When removing a piston ring, open the end gap with your fingers and lift the other side of the ring over the piston crown.

**Cylinder and piston inspection**

The following procedure applies to all of the cylinders and pistons.

1. Check:
   - Piston wall
   - Cylinder wall
     Vertical scratches → Replace the cylinder, and the piston and piston rings as a set.




2. Measure:
   - Piston-to-cylinder clearance

**Measurement steps:**
- Measure cylinder bore “C” with the cylinder bore gauge.

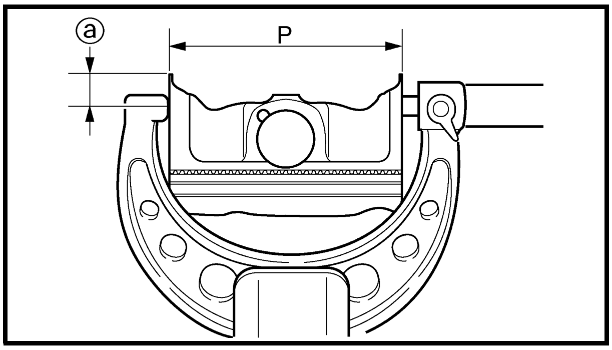
**NOTE:**
Measure cylinder bore “C” by taking side-to-side and front-to-back measurements of the cylinder. Then, find the average of the measurements.

| | |
|---|---|
| **Cylinder bore “C”** | **74.060–74.075 mm (2.9157–2.9163 in)** |
| **Taper limit “T”** | **0.08 mm (0.003 in)** |
| **Out of round “R”** | **0.05 mm (0.002 in)** |

**“C” = maximum of $D_1$–$D_6$**

**“T” = maximum of $D_1$–$D_5$ (direction ⓓ) and $D_2$–$D_6$ (direction ⓔ)**

**“R” = maximum of $D_2$–$D_1$ (measuring point ⓐ) and $D_6$–$D_5$ (measuring point ⓒ)**




- If out of specification, replace the piston and piston rings as a set.
- Measure piston skirt diameter “P” with the micrometer.

ⓐ 5 mm (0.2 in) from the bottom edge of the piston

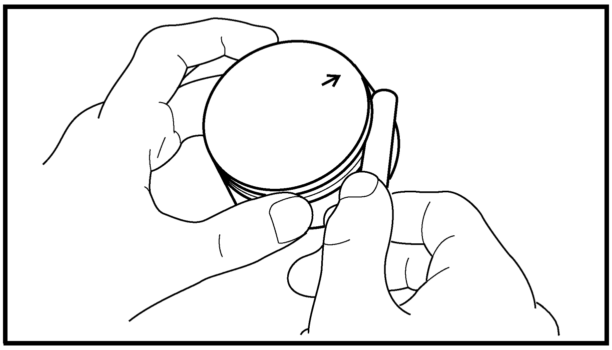
| | Piston size “P” |
|---|---|
| Standard | 73.955–73.970 mm (2.9116–2.9121 in) |

- If out of specification, replace the piston and piston rings as a set.
- Calculate the piston-to-cylinder clearance with the following formula.

**Piston-to-cylinder clearance =**
**Cylinder bore “C” –**
**Piston skirt diameter “P”**

**Piston-to-cylinder clearance:**
**0.10–0.11 mm (0.0039–0.0043 in)**
**<Limit>: 0.17 mm (0.0067 in)**

- If out of specification, replace the piston and piston rings as a set.

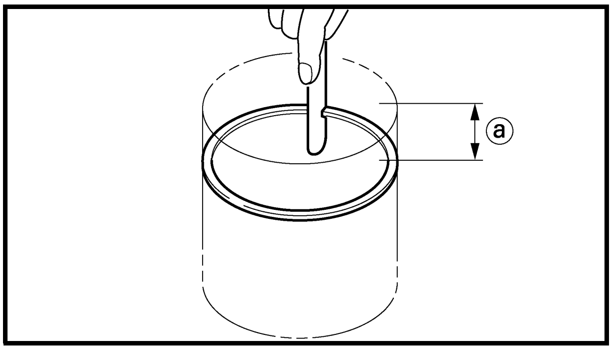


**Piston ring inspection**

1. Measure:
   - Piston ring side clearance
     Out of specification → Replace the piston and piston rings as a set.

**NOTE:**
Before measuring the piston ring side clearance, eliminate any carbon deposits from the piston ring grooves and piston rings.

**Piston ring groove:**
**Top ring:**
**0.030–0.065 mm**
**(0.0012–0.0026 in)**
**2nd ring:**
**0.020–0.055 mm**
**(0.0008–0.0022 in)**



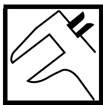

2. Install:
   - Piston ring
     (into the cylinder)

**NOTE:**
Level the piston ring in the cylinder with the piston crown.

ⓐ 5 mm (0.2 in)

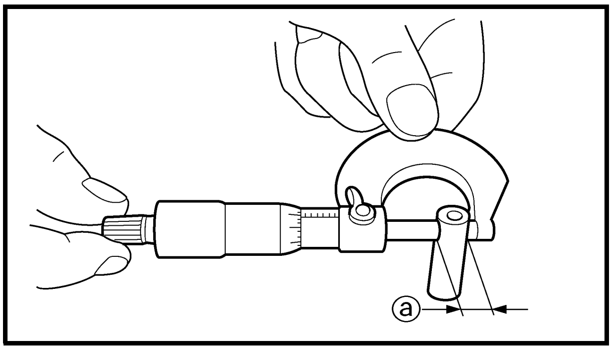
3. Measure:
   - Piston ring end gap
     Out of specification → Replace the piston ring.

**NOTE:**
The oil ring expander spacer's end gap cannot be measured. If the oil ring rail's gap is excessive, replace all three piston rings.



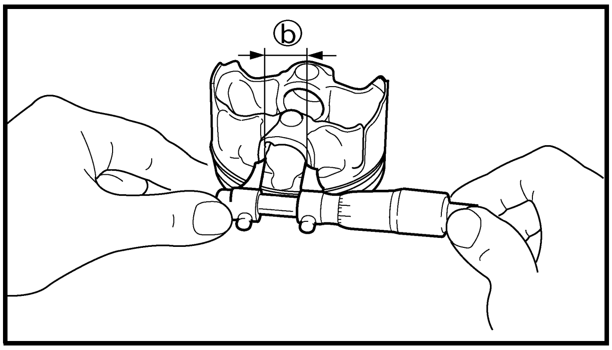
**Piston ring end gap:**
**Top ring:**
**0.38–0.55 mm**
**(0.0150–0.0217 in)**
**2nd ring:**
**0.49–0.69 mm**
**(0.0193–0.0272 in)**
**Oil ring:**
**0.29–0.59 mm**
**(0.0114–0.0232 in)**

**Piston pin inspection**
The following procedure applies to all of the piston pins.
1. Check:
   - Piston pin
     Blue discoloration/grooves → Replace the piston pin and then check the lubrication system.




2. Measure:
   - Piston pin outside diameter ⓐ
     Out of specification → Replace the piston pin.

**Piston pin outside diameter:**
**16.991–17.000 mm**
**(0.6689–0.6693 in)**
**<Limit>: 16.971 mm (0.6681 in)**




3. Measure:
   - Piston pin bore diameter (in the piston) ⓑ
     Out of specification → Replace the piston.

**Piston pin bore diameter (in the piston):**
**17.002–17.013 mm**
**(0.6693–0.6698 in)**

4. Calculate:
   - Piston-pin-to-piston clearance
     Out of specification → Replace the piston pin.

**Piston-pin-to-piston clearance =**
**Piston pin bore diameter (in the piston) ⓑ – Piston pin outside diameter ⓐ**

**Piston-pin-to-piston clearance:**
**0.002–0.042 mm**
**(0.0001–0.0017 in)**

### Connecting rod inspection

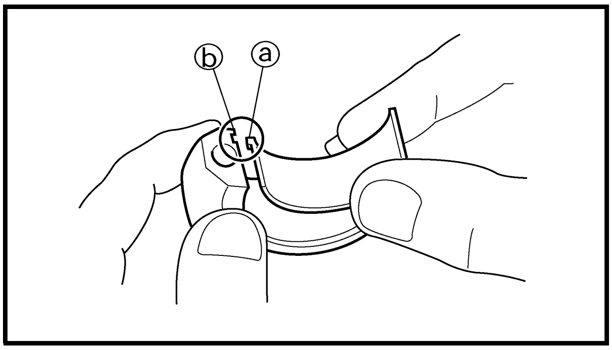
1. Measure:
   - Crankshaft-pin-to-big-end-bearing clearance
     Out of specification → Replace the big end bearings.

**Crankshaft-pin-to-big-end-bearing clearance:**
**0.016–0.040 mm**
**(0.0006–0.0016 in)**

**Measurement steps:**
The following procedure applies to all of the connecting rods.

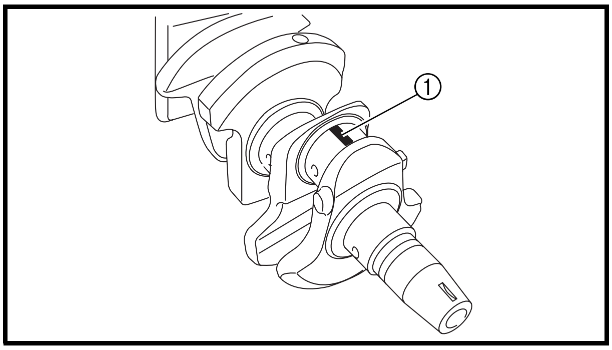
**CAUTION:**

**Do not interchange the big end bearings and connecting rods. To obtain the correct crankshaft-pin-to-big-end-bearing clearance and prevent engine damage, the big end bearings must be installed in their original positions.**

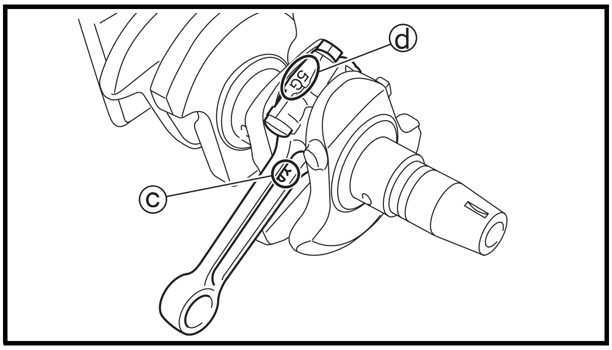


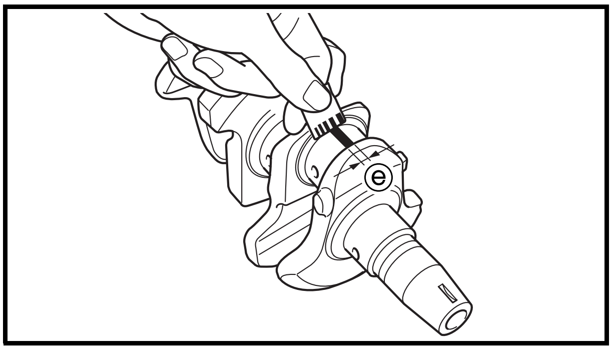

- Clean the big end bearings, crankshaft pins, and the inside of the connecting rod halves.
- Install the big end upper bearing into the connecting rod and the big end lower bearing into the connecting rod cap.

**NOTE:**
Align the projections ⓐ on the big end bearings with the notches ⓑ in the connecting rod and connecting rod cap.



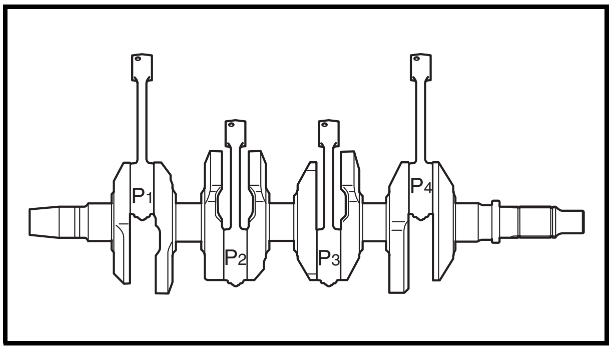

- Put a piece of Plastigauge® ① on the crankshaft pin.
- Assemble the connecting rod halves.



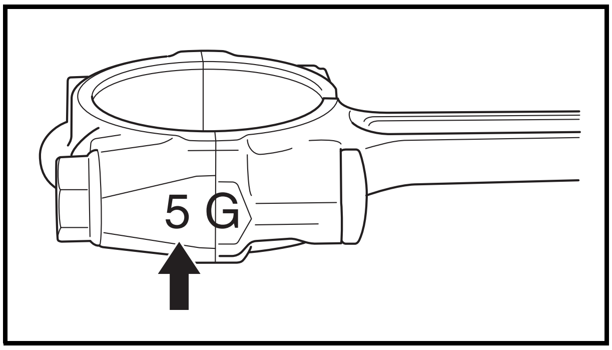

**NOTE:**
- Do not move the connecting rod or crankshaft until the clearance measurement has been completed.
- Lubricate the bolts threads and nut seats with molybdenum disulfide grease.
- Make sure the “Y” mark ⓒ on the connecting rod faces towards the front side of the crankshaft.
- Make sure the characters ⓓ on both the connecting rod and connecting rod cap are aligned.

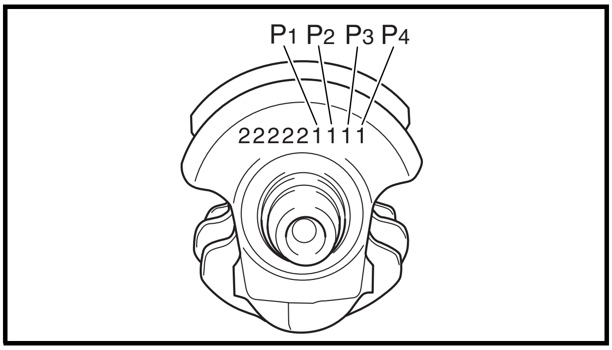
- Tighten the connecting rod nuts.
  Refer to “Connecting rod and piston installation”.
- Remove the connecting rod and big end bearings.
  Refer to “Connecting rod and piston removal”.
- Measure the compressed Plastigauge® width ⓔ on the crankshaft pin.
  If the crankshaft-pin-to-big-end-bearing clearance is out of specification, select replacement big end bearings.




2. Select:
   - Big end bearings ($P_1$–$P_4$)

**NOTE:**
- The numbers stamped into the crankshaft web and the numbers on the connecting rods are used to determine the replacement big end bearing sizes.
- “$P_1$”–”$P_4$” refer to the bearings shown in the crankshaft illustration.

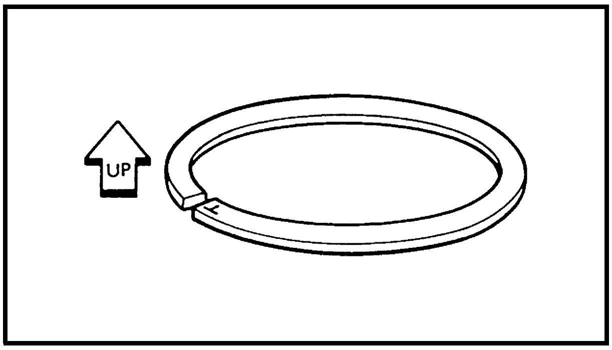



For example, if the connecting rod “$P_1$” and the crankshaft web “$P_1$” numbers are “5” and “1” respectively, then the bearing size for “$P_1$” is:

**Bearing size of $P_1$:**
**“$P_1$” (connecting rod) –**
**“$P_1$” (crankshaft web)**
**5 – 1 = 4 (green)**

| BEARING COLOR CODE | |
|---|---|
| **1** | **brown** |
| **2** | **black** |
| **3** | **blue** |
| **4** | **green** |

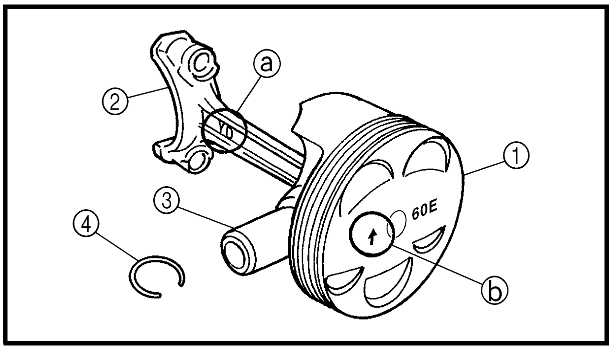



**Connecting rod and piston installation**

The following procedure applies to all of the pistons and connecting rods.

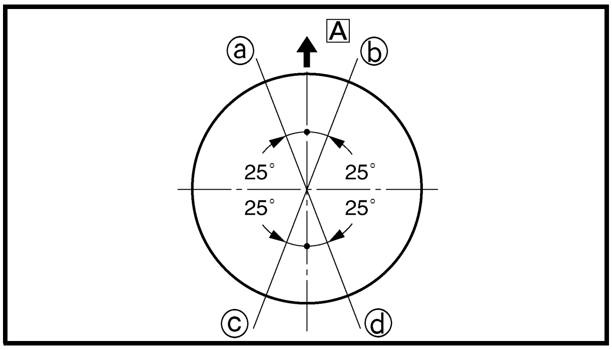
1. Install:
   - Top ring
   - 2nd ring
   - Oil ring

**NOTE:**
Be sure to install the piston rings so that the manufacturer’s marks or numbers face up.




2. Install:
   - Piston ①
   - Connecting rod ②
   - Piston pin ③
   - Piston pin clip ④

**NOTE:**
- Apply engine oil onto the piston pin.
- Make sure that the “Y” mark ⓐ on the connecting rod left when the arrow mark ⓑ on the piston is pointing up. Refer to the illustration.
- Reinstall each piston into its original cylinder (numbering order starting from the front: #1 to #4).




3. Offset:
   - Piston ring end gaps

ⓐ Top ring
ⓑ Lower oil ring rail
ⓒ Upper oil ring rail
ⓓ 2nd ring
A Intake side

4. Lubricate:
   - Piston
   - Piston rings
   - Cylinder
   (with the recommended lubricant)

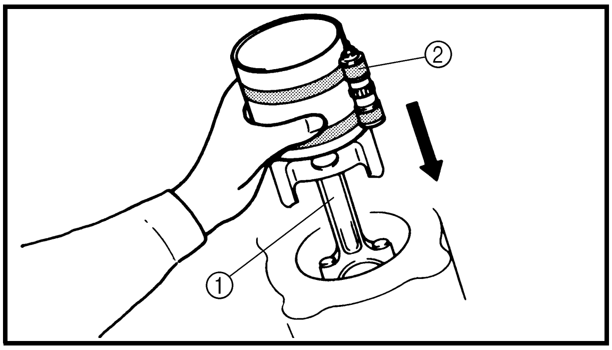
**Recommended lubricant:**
**Engine oil**

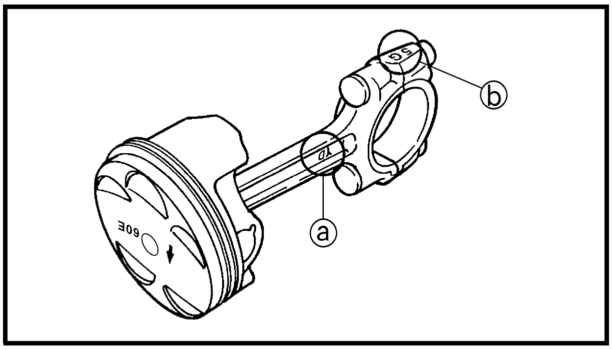
5. Lubricate:
   - Bolt threads
   - Nut seats
   (with the recommended lubricant)

**Recommended lubricant:**
**Molybdenum disulfide grease**

6. Lubricate:
   - Crankshaft pins
   - Big end bearings
   - Connecting rod inner surface
   (with the recommended lubricant)

**Recommended lubricant:**
**Engine oil**



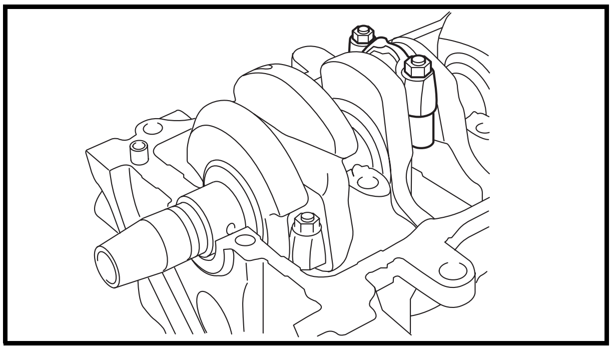




7. Install:
   - Big end bearings
   - Connecting rod assembly ①
     (into the cylinder and onto the crankshaft pin)
   - Connecting rod cap
     (onto the crankshaft pin)

**NOTE:**
- Align the projections on the big end bearings with the notches in the connecting rods and connecting rod caps.
- Be sure to reinstall each big end bearing in its original place.
- While compressing the piston rings with piston ring compressor ②, install the connecting rod assembly into the cylinder with the other hand.
- Make sure the "Y" marks ⓐ on the connecting rods face towards the front side of the crankshaft.
- Make sure the characters ⓑ on both the connecting rod and connecting rod cap are aligned.

**Piston ring compressor:**
**YM-08037/90890-05158**

8. Align:
   - Bolt heads
     (with the connecting rod)

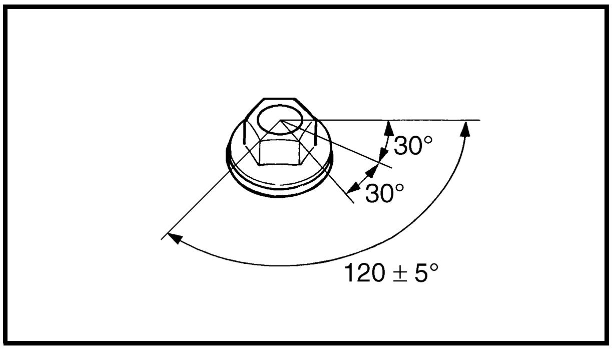


9. Tighten:
   - Connecting rod nuts

**⚠ WARNING**

- **Replace the connecting rod bolts and nuts with new ones.**
- **Clean the connecting rod bolts and nuts.**

**NOTE:**
The tightening procedure of the connecting rod nuts is angle controlled, therefore tighten the nuts using the following procedure.




**Tightening steps:**

- Tighten the connecting rod nuts to the specified torque.

**Connecting rod nut:**
**1st:**
**20 N • m (2.0 kgf • m, 14 ft • lb)**

- Tighten the connecting rod nuts further to reach the specified angle 120°.

**Connecting rod nut:**
**Final:**
**Specified angle 120 ± 5°**

**⚠ WARNING**

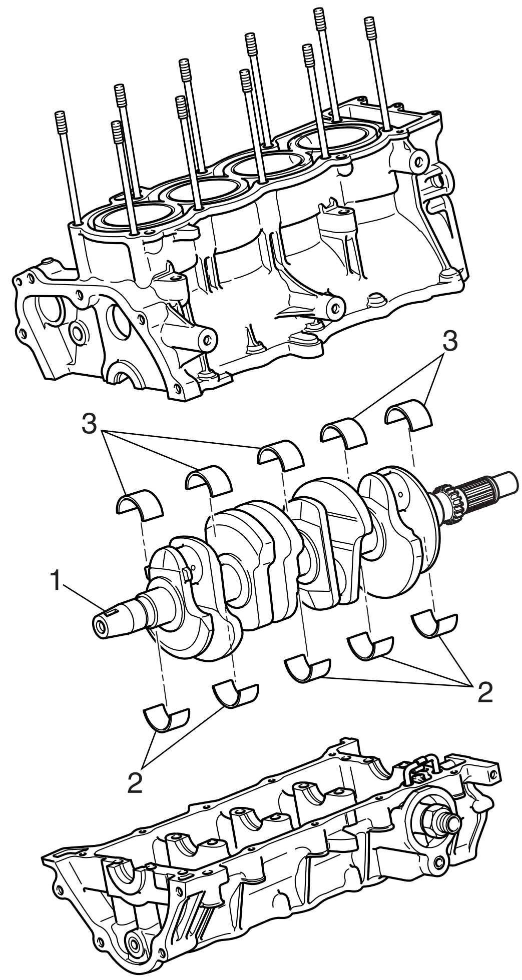
**When the nuts are tightened more than the specified angle, do not loosen the nut and then retighten it.**
**Replace the nut with a new one and perform the procedure again.**

**CAUTION:**

- **Do not use a torque wrench to tighten the nut to the specified angle.**
- **Tighten the nut until it is at the specified angle.**

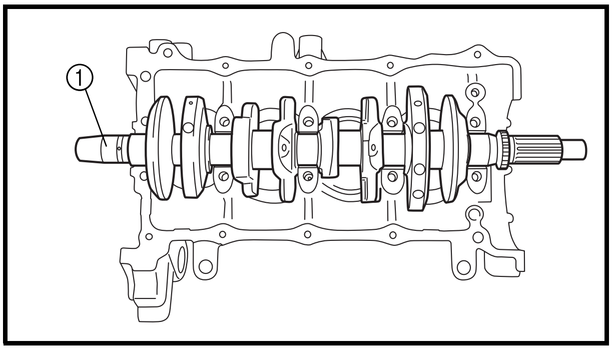
**NOTE:**
When using a hexagonal nut, note that the angle from one corner to another is 60°.

# CRANKSHAFT
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CRANKSHAFT REMOVAL** | | Follow the left "Step" for removal. |
| | Crankcase | | Separate<br>Refer to "CRANKCASE". |
| | Connecting rod caps | | Refer to "CONNECTING RODS AND PISTONS". |
| 1 | Crankshaft | 1 | |
| 2 | Crankshaft journal lower bearing | 5 | |
| 3 | Crankshaft journal upper bearing | 5 | |
| | | | Reverse the removal steps for installation. |

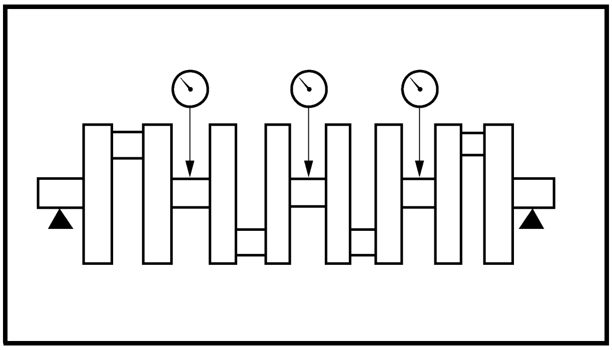



## SERVICE POINTS

### Crankshaft removal

1. Remove:
   - Crankshaft ①
   - Crankshaft journal lower bearings (from the lower crankcase)
   - Crankshaft journal upper bearings (from the upper crankcase)

**NOTE:**
Identify the position of each crankshaft journal bearing so that it can be reinstalled in its original place.



### Crankshaft inspection

1. Measure:
   - Crankshaft runout
     Out of specification → Replace the crankshaft.

**Maximum crankshaft runout:**
**0.03 mm (0.0012 in)**

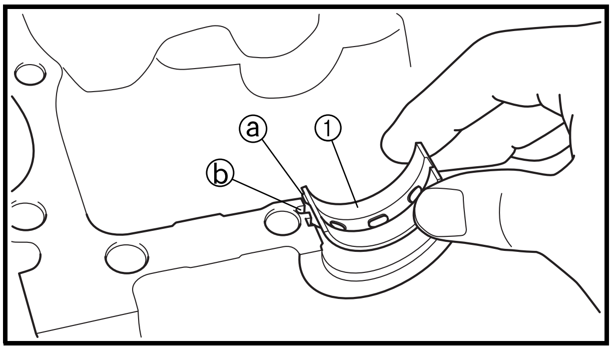
2. Check:
   - Crankshaft journal surfaces
   - Crankshaft pin surfaces
   - Bearing surfaces
     Scratches/wear → Replace the crankshaft.

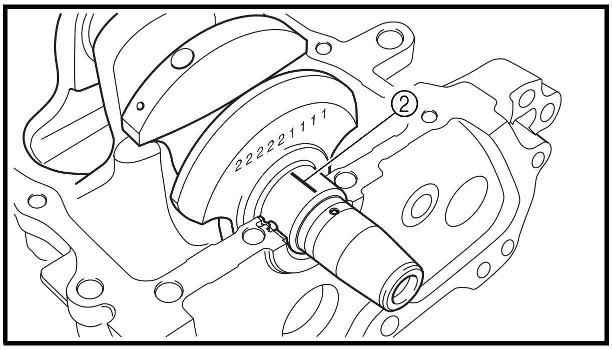
3. Measure:
   - crankshaft-journal-to-crankshaft-journal-bearing clearance
     Out of specification → Replace the crankshaft journal bearings.

**Crankshaft-journal-to-crankshaft-journal-bearing clearance:**
**0.020–0.057 mm**
**(0.0008–0.0022 in)**

**CAUTION:**

**Do not interchange the crankshaft journal bearings. To obtain the correct crankshaft-journal-to-crankshaft-journal-bearing clearance and prevent engine damage, the crankshaft journal bearings must be installed in their original positions.**




**Measurement steps:**
- Clean the crankshaft journal bearings, crankshaft journals, and bearing portions of the crankcase.
- Place the upper crankcase upside down on a bench.
- Install the crankshaft journal upper bearings ① and the crankshaft into the upper crankcase.

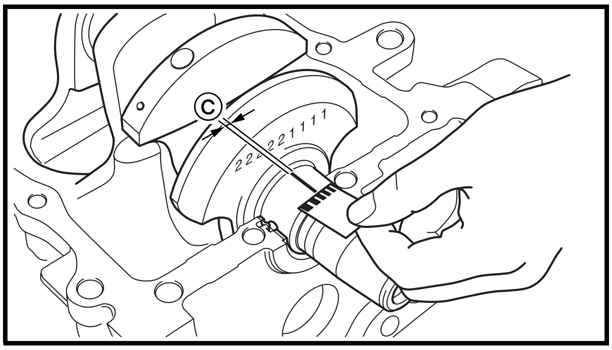
**NOTE:**
Align the projections ⓐ of the crankshaft journal upper bearings with the notches ⓑ in the upper crankcase.

- Put a piece of Plastigauge® ② on each crankshaft journal.

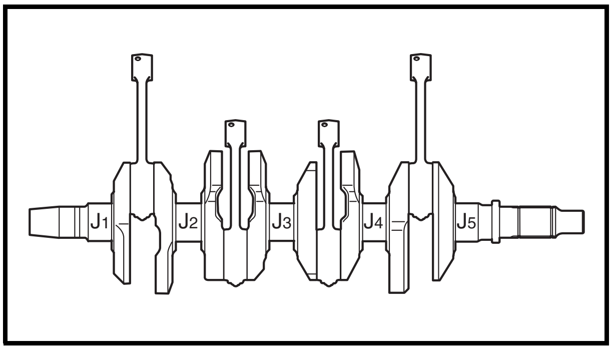
**NOTE:**
Do not put the Plastigauge® over the oil hole in the crankshaft journal.

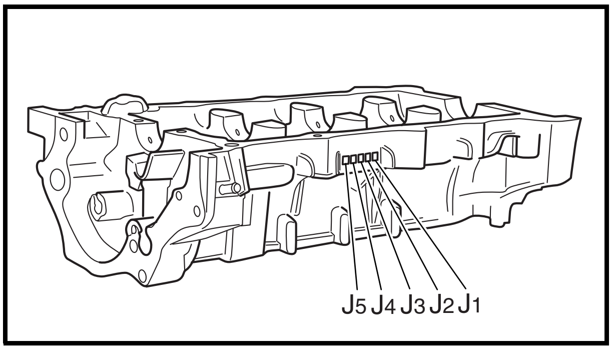
- Install the crankshaft journal lower bearings into the lower crankcase and assemble the crankcase halves.

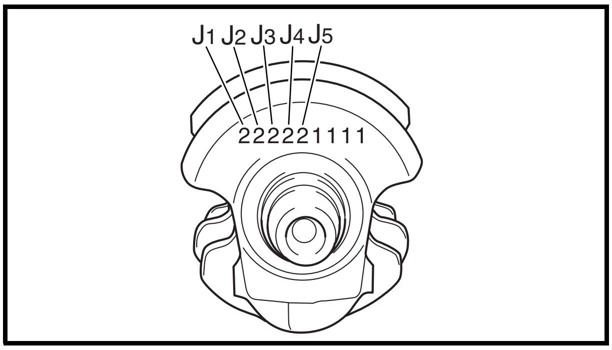
**NOTE:**
- Align the projections ⓐ of the crankshaft journal lower bearings with the notches ⓑ in the lower crankcase.
- Do not move the crankshaft until the clearance measurement has been completed.




- Tighten the bolts to specification in the tightening sequence cast on the crankcase.
  Refer to “Crankcase assembly”—“CRANKCASE”.
- Remove the lower crankcase and the crankshaft journal lower bearings.
- Measure the compressed Plastigauge® width Ⓒ on each crankshaft journal.
  If the crankshaft-journal-to-crankshaft-journal-bearing clearance is out of specification, select replacement crankshaft journal bearings.



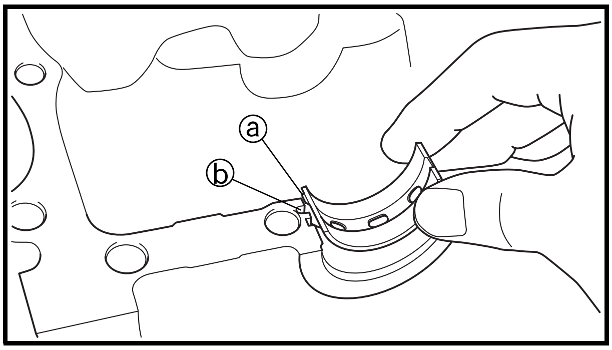

4. Select:
   - Crankshaft journal bearings ($J_1$–$J_5$)

**NOTE:**
- The numbers stamped into the crankshaft web and the numbers stamped into the lower crankcase are used to determine the replacement crankshaft journal bearing sizes.
- “$J_1$–$J_5$” refer to the bearings shown in the crankshaft illustration.
- If “$J_1$–$J_5$” are the same, use the same size for all of the bearings.

For example, if the crankcase “$J_1$” and crankshaft web “$J_1$” numbers are “5” and “2” respectively, then the bearing size for “$J_1$” is:

**Bearing size of $J_1$:**
**“$J_1$” (crankcase) – “$J_1$” (crankshaft web)**
**5 – 2 = 3 (blue)**

| BEARING COLOR CODE | |
|---|---|
| **1** | **brown** |
| **2** | **black** |
| **3** | **blue** |
| **4** | **green** |
| **5** | **yellow** |




**Crankshaft installation**

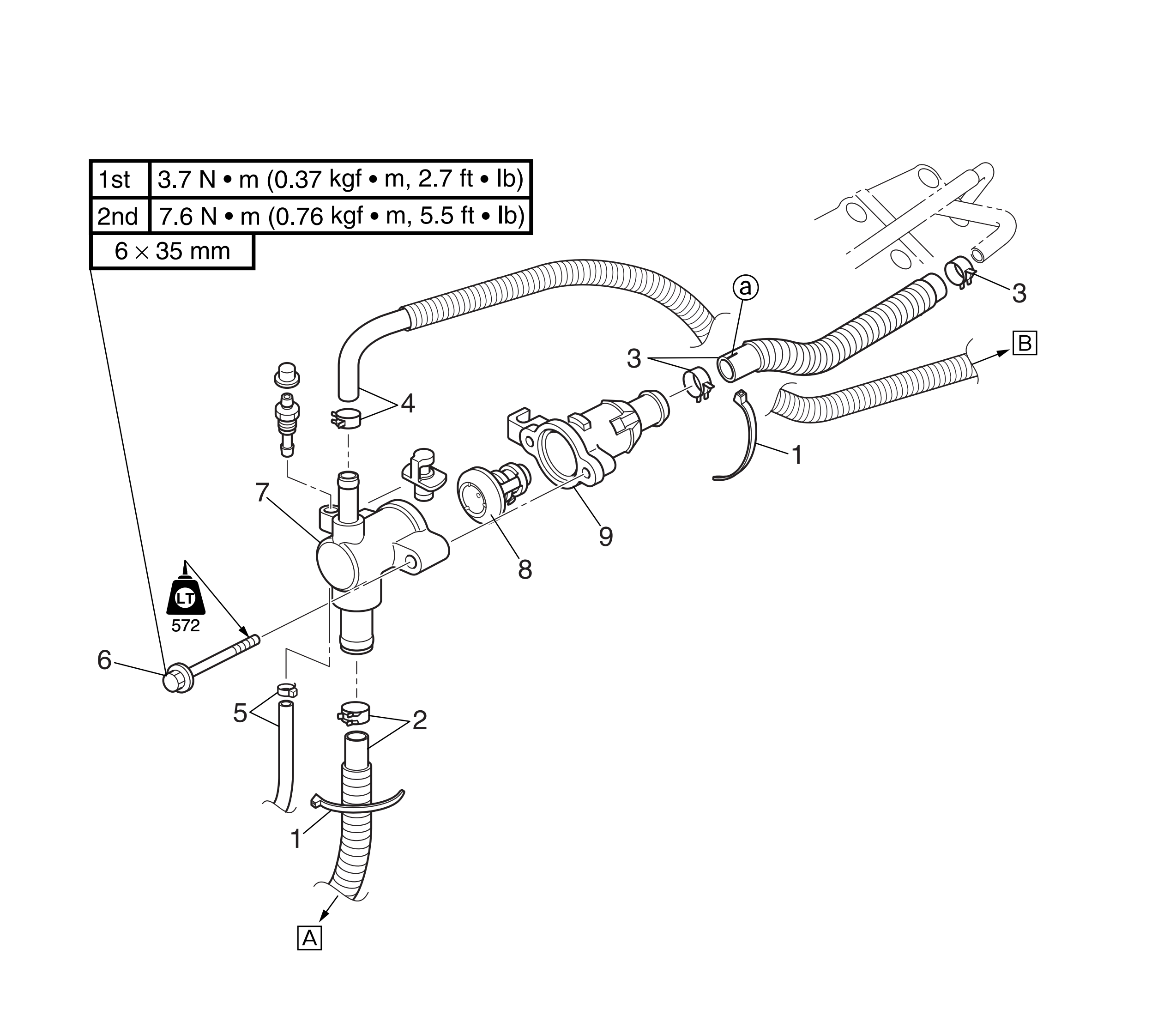
1. Install:
   - Crankshaft journal upper bearings (into the upper crankcase)
   - Crankshaft journal lower bearings (into the lower crankcase)

**NOTE:**
- Align the projections ⓐ on the crankshaft journal upper bearings with the notches ⓑ in the upper crankcase.
- Be sure to install each crankshaft journal bearing in its original place.

2. Lubricate:
   - Crankshaft pins
   - Connecting rod inner surface (with the recommended lubricant)

| | |
|---|---|
| | **Recommended lubricant:**<br>**Engine oil** |

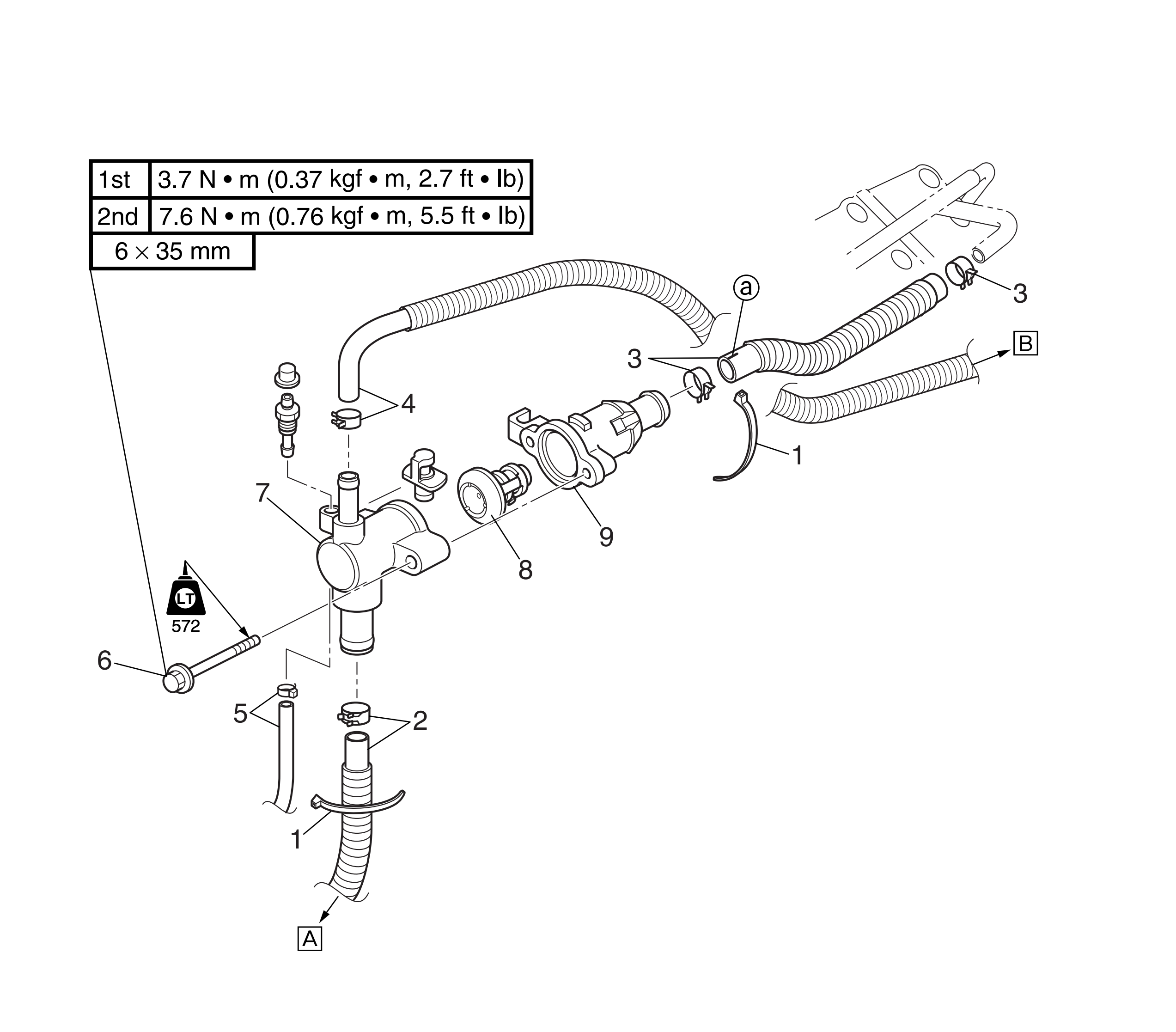
# THERMOSTAT
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

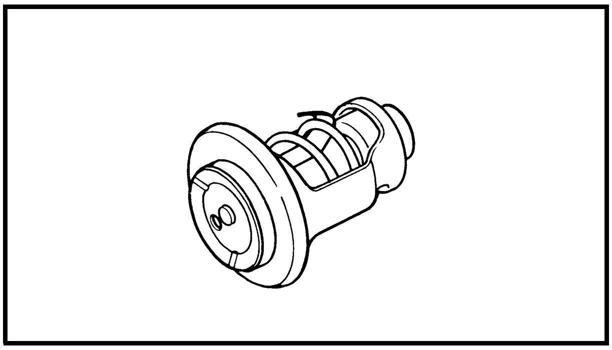
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **THERMOSTAT REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Band | 2 | |
| 2 | Clamp/cooling water hose | 1/1 | A For cooling water outlet on stern side. |
| 3 | Clamp/cooling water hose | 2/1 | **NOTE:** Install the cooling water hose with the white mark ⓐ facing up. |
| 4 | Clamp/cooling water hose | 1/1 | B For cooling water pilot outlet on starboard side. |
| 5 | Band/grease hose | 1/1 | |
| 6 | Bolt | 2 | |
| 7 | Thermostat housing cover | 1 | |

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Thermostat | 1 | |
| 9 | Thermostat housing | 1 | |
| | | | Reverse the removal steps for installation. |

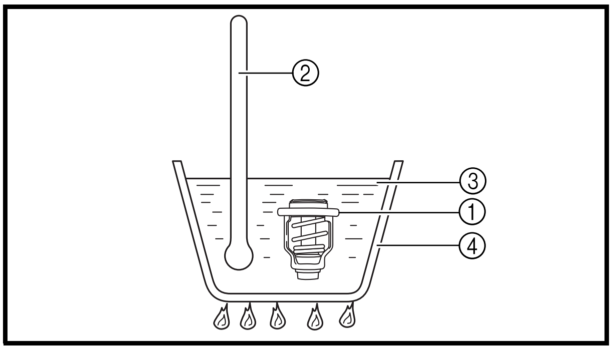


## SERVICE POINTS

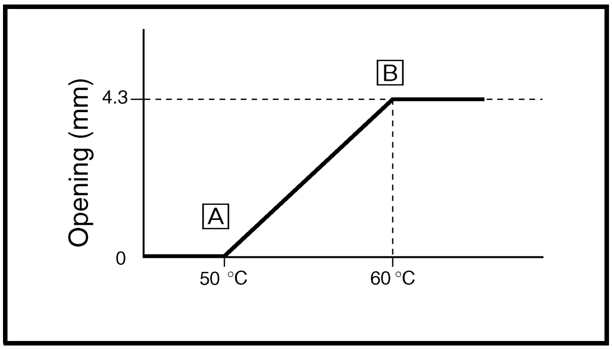
### Thermostat inspection

1. Check:
   - Thermostat ①
     Does not open at 50–60 °C (123–141 °F) → Replace.

**Checking steps:**
- Suspend the thermostat in a container filled with water.
- Slowly heat the water.
- Place a thermometer in the water.
- While stirring the water, observe the thermostat and thermometer's indicated temperature.

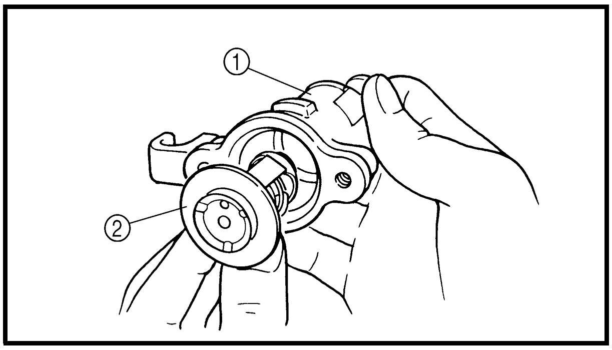



① Thermostat
② Thermometer
③ Water
④ Container
A Fully closed
B Fully open




**NOTE:**
If the accuracy of the thermostat is in doubt, replace it. A faulty thermostat could cause serious overheating or over cooling.

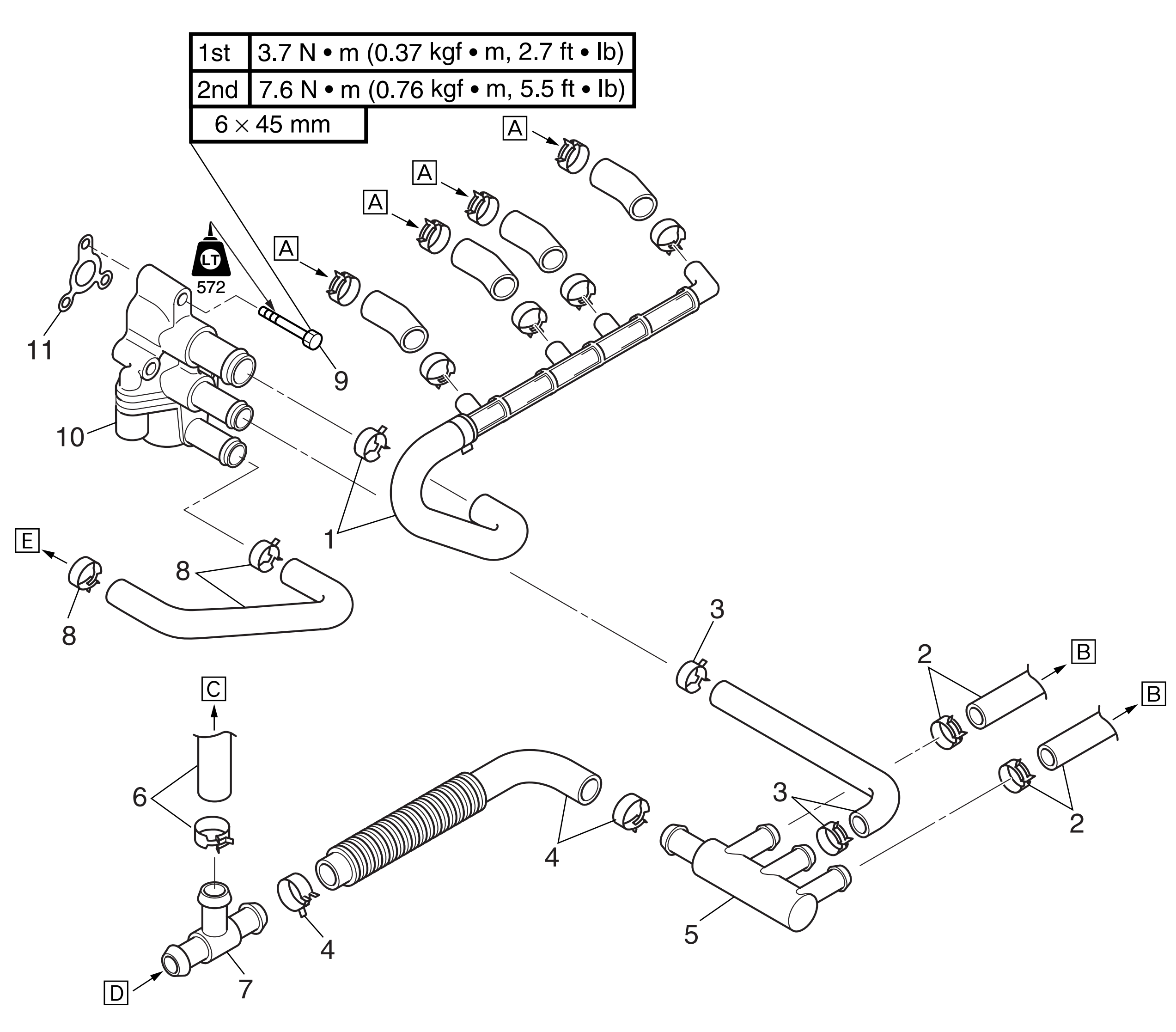
2. Check:
   - Thermostat housing cover
   - Thermostat housing
     Cracks/damage → Replace.
3. Check:
   - Cooling system
     Leaks → Repair or replace any faulty part.




### Thermostat installation

1. Install:
   - Thermostat housing ①
   - Thermostat ②
   - Thermostat housing cover

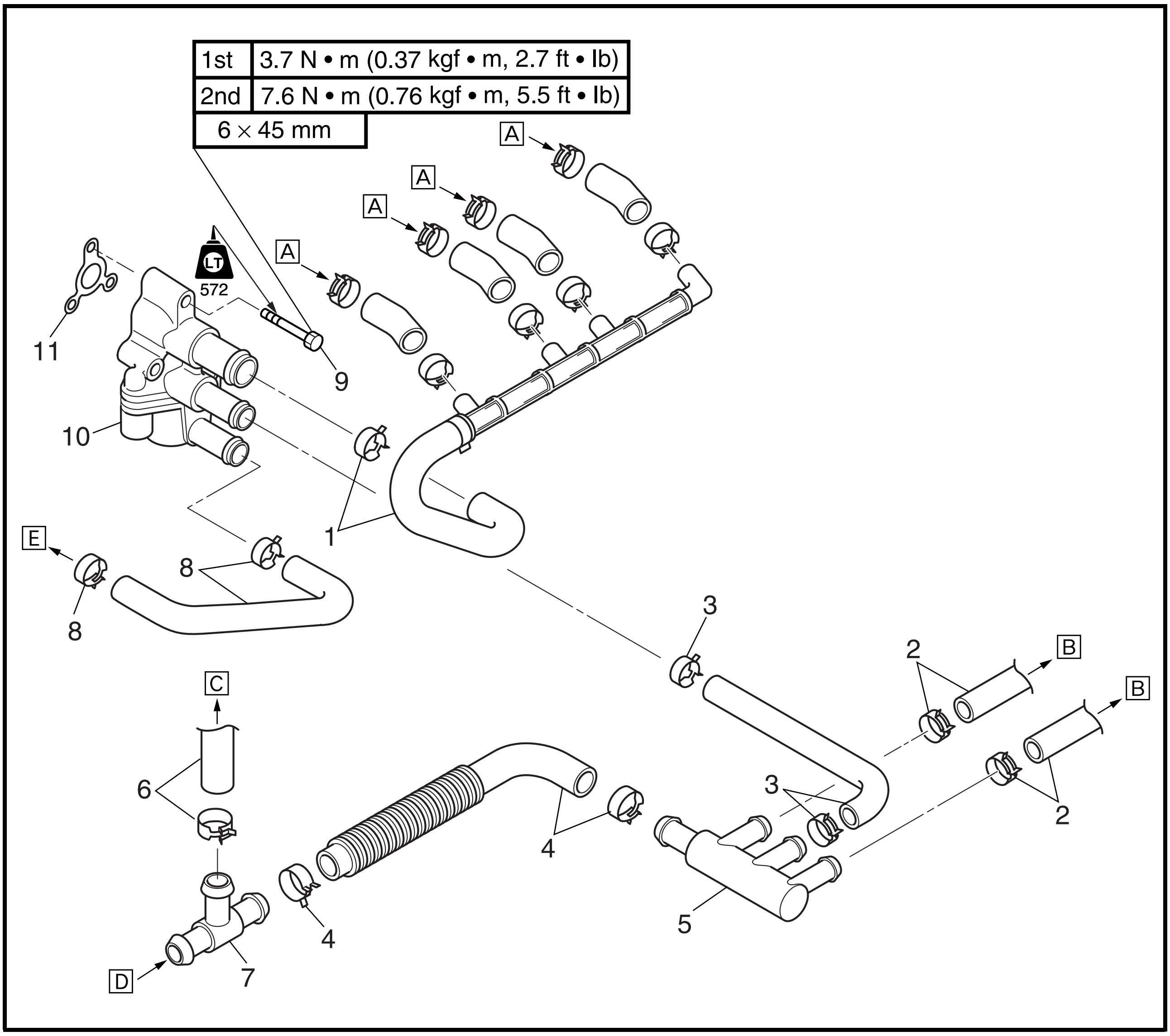
# PRESSURE CONTROL VALVE
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **PRESSURE CONTROL VALVE REMOVAL** | | Follow the left "Step" for removal. |
| | Exhaust manifold | | Refer to "EXHAUST MANIFOLD". |
| 1 | Clamp/cooling water hose | 1/1 | A From exhaust manifold |
| 2 | Clamp/cooling water hose | 2/2 | B To exhaust pipe |
| 3 | Clamp/cooling water hose | 2/1 | |
| 4 | Clamp/cooling water hose | 2/1 | |
| 5 | Joint | 1 | |
| 6 | Clamp/cooling water hose | 1/1 | C To oil tank |
| 7 | Joint | 1 | D From cooling water inlet |
| 8 | Clamp/cooling water hose | 2/1 | E To oil tank |

## EXPLODED DIAGRAM



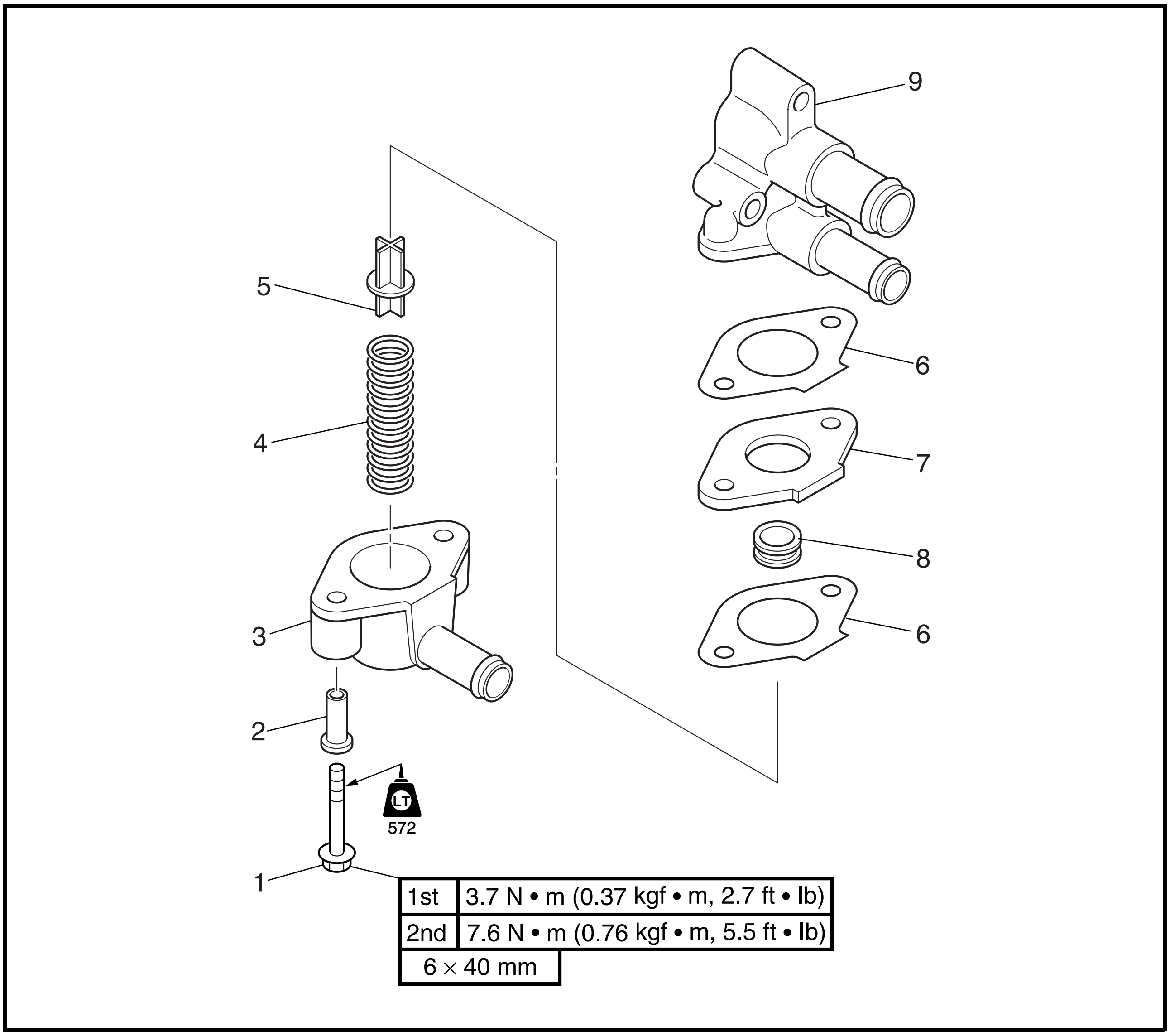

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Bolt | 3 | |
| 10 | Pressure control valve assembly | 1 | |
| 11 | Gasket | 1 | **Not reusable** |
| | | | Reverse the removal steps for installation. |

# PRESSURE CONTROL VALVE



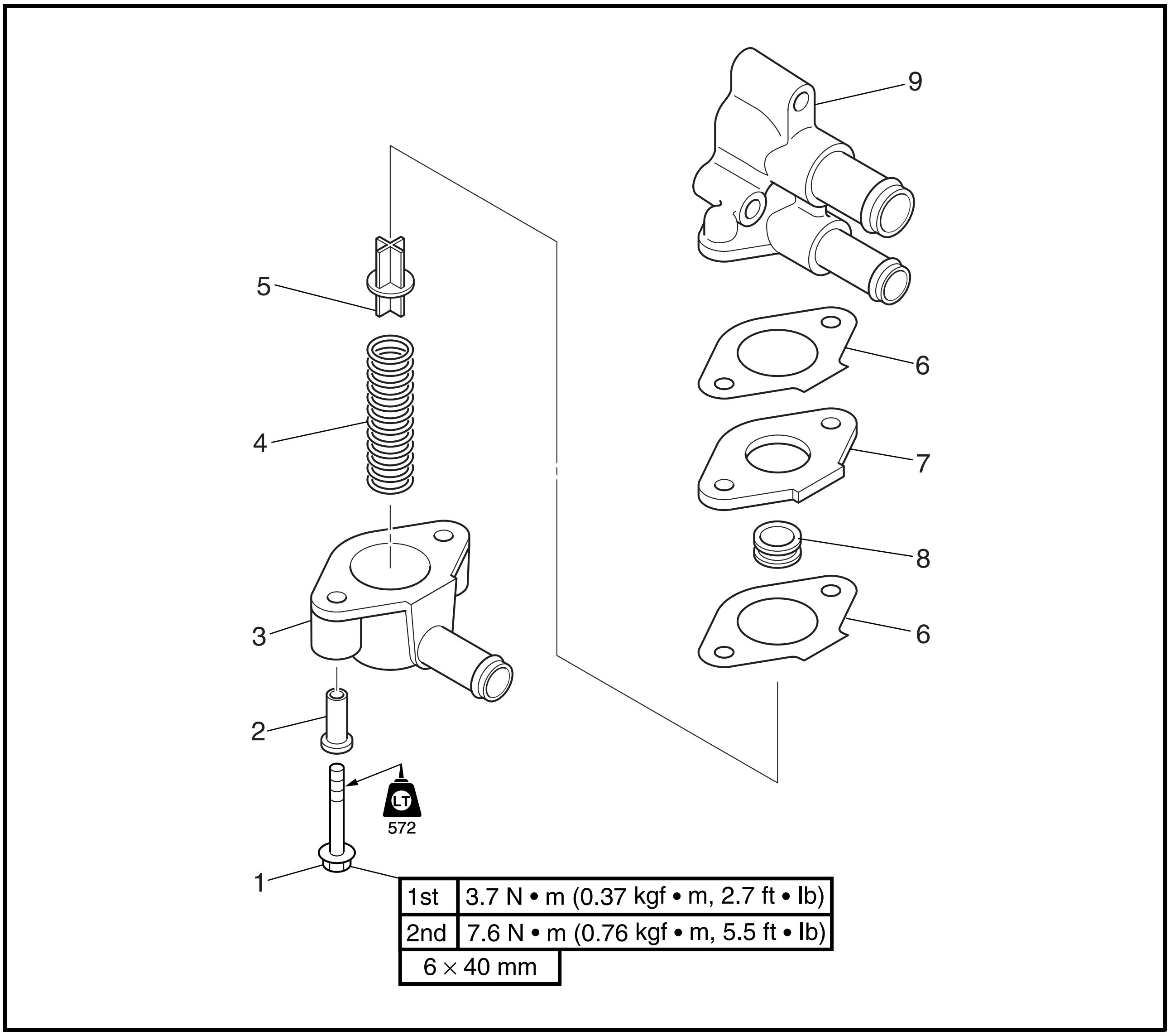
## EXPLODED DIAGRAM



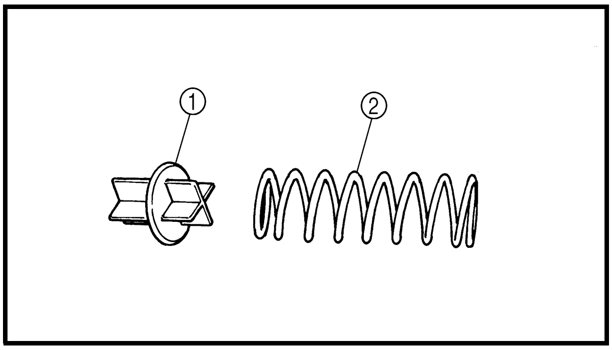

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **PRESSURE CONTROL VALVE DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt | 2 | |
| 2 | Collar | 2 | |
| 3 | Pressure control valve housing cover | 1 | |
| 4 | Spring | 1 | |
| 5 | Pressure control valve | 1 | |
| 6 | Gasket | 2 | **Not reusable** |
| 7 | Plate | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Grommet | 1 | |
| 9 | Pressure control valve housing | 1 | |
| | | | Reverse the disassembly steps for assembly. |



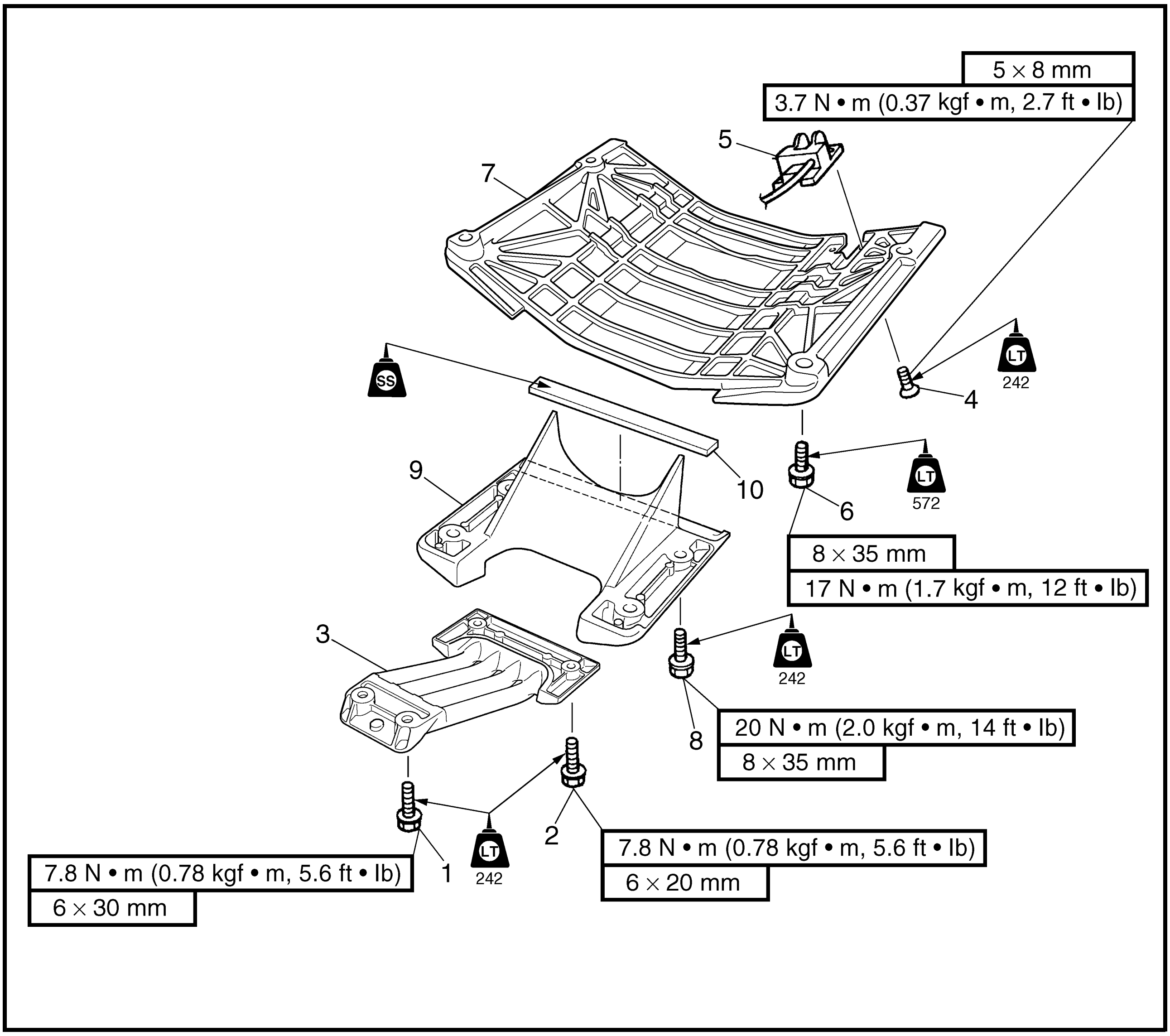

## SERVICE POINTS

### Pressure control valve inspection

1. Check:
   - Pressure control valve ①
   - Spring ②
     Damage/wear → Replace the defective part(s).
2. Check:
   - Pressure control valve housing cover
   - Pressure control valve housing
     Cracks/damage → Replace.
3. Check:
   - Cooling system
     Leaks → Repair or replace any faulty part.

# CHAPTER 6
# JET PUMP UNIT

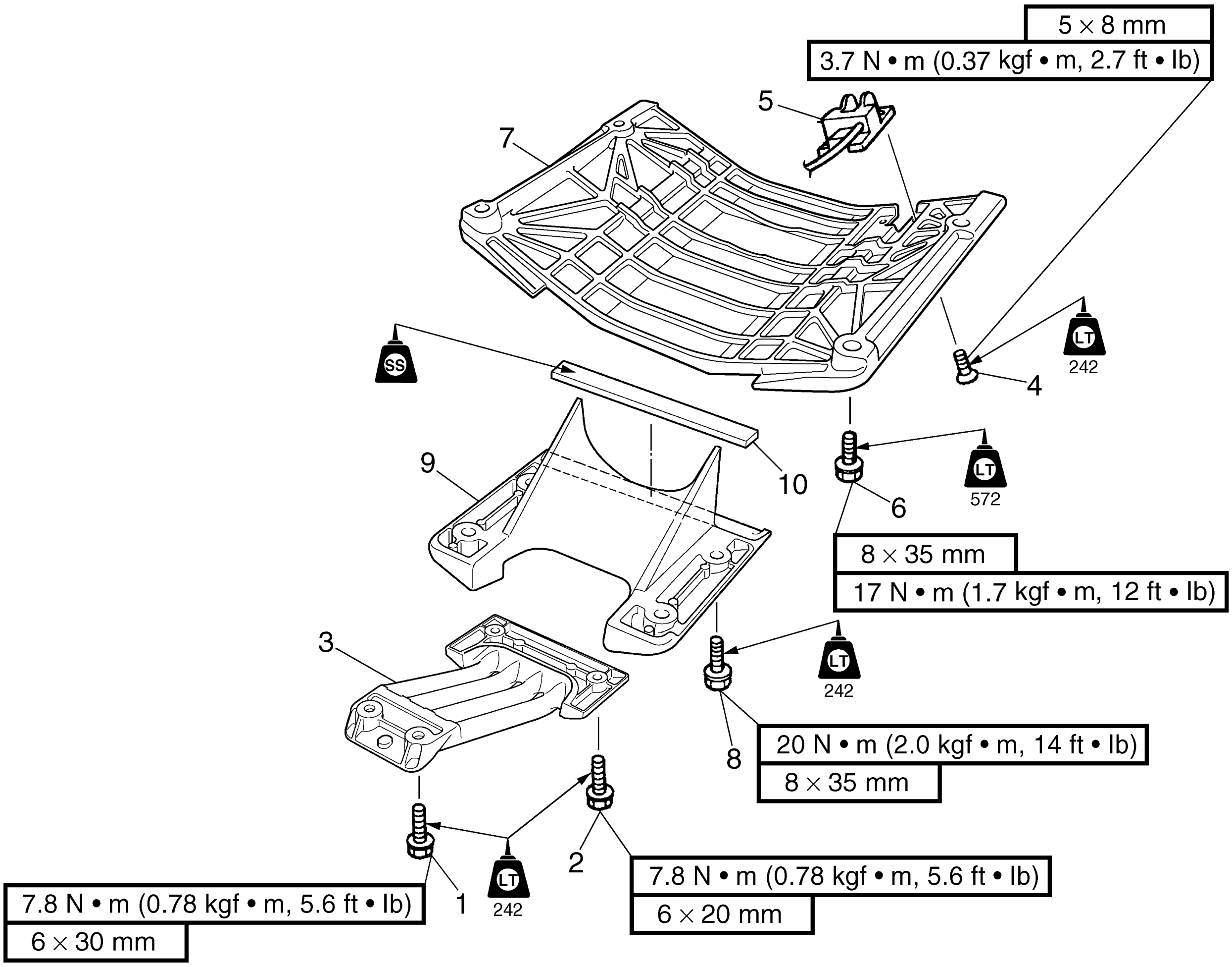
# INTAKE GRATE, RIDE PLATE, AND INTAKE DUCT
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

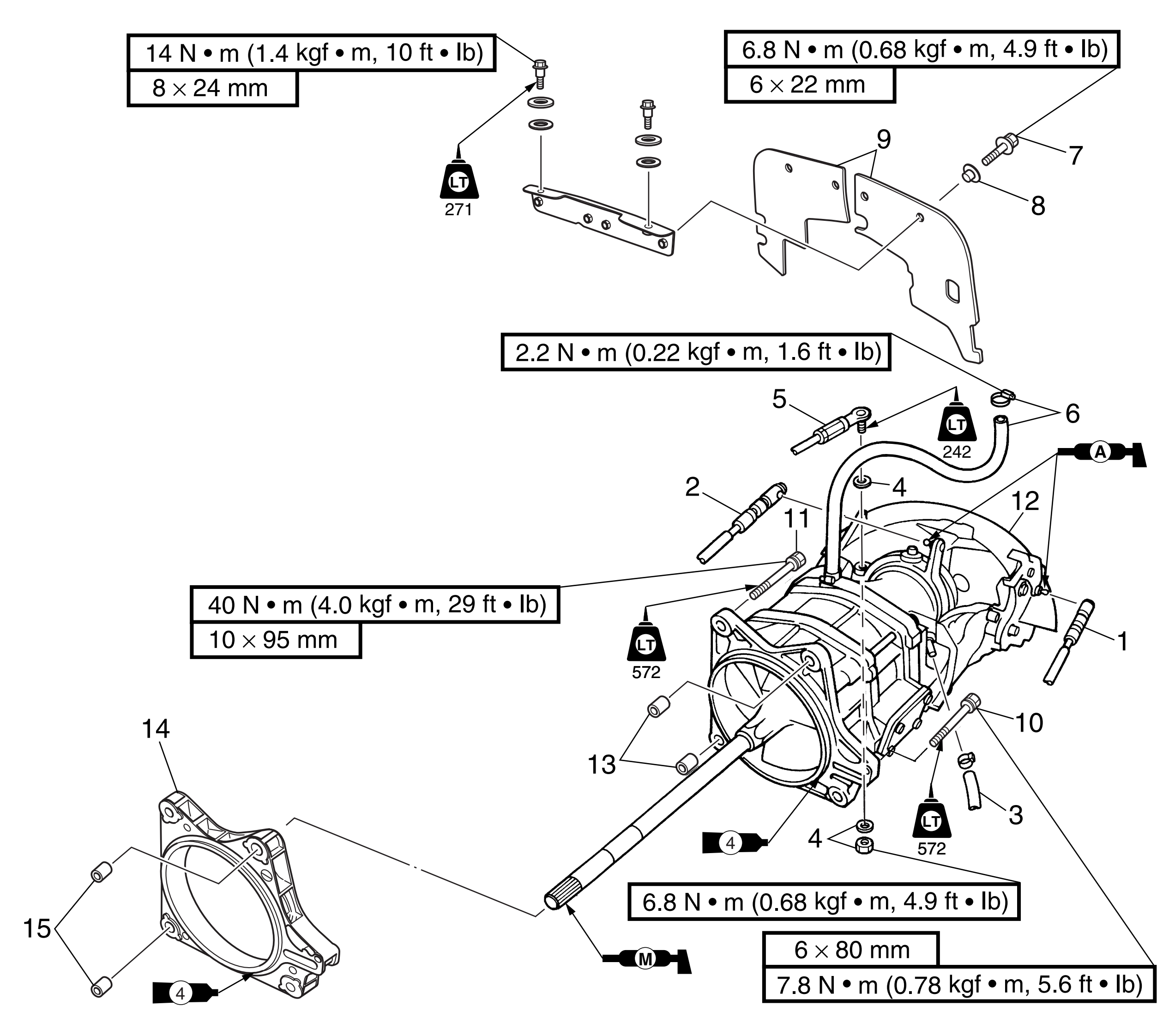
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **INTAKE GRATE, RIDE PLATE, AND INTAKE DUCT REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Bolt | 2 | |
| 2 | Bolt | 2 | |
| 3 | Intake grate | 1 | |
| 4 | Screw | 4 | |
| 5 | Speed sensor | 1 | **NOTE:** Route the speed sensor lead between the jet pump unit and the bilge hose. |
| 6 | Bolt | 4 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Ride plate | 1 | |
| 8 | Bolt | 4 | |
| 9 | Intake duct | 1 | |
| 10 | Felt packing | 1 | **Not reusable** |
| | | | Reverse the removal steps for installation. |

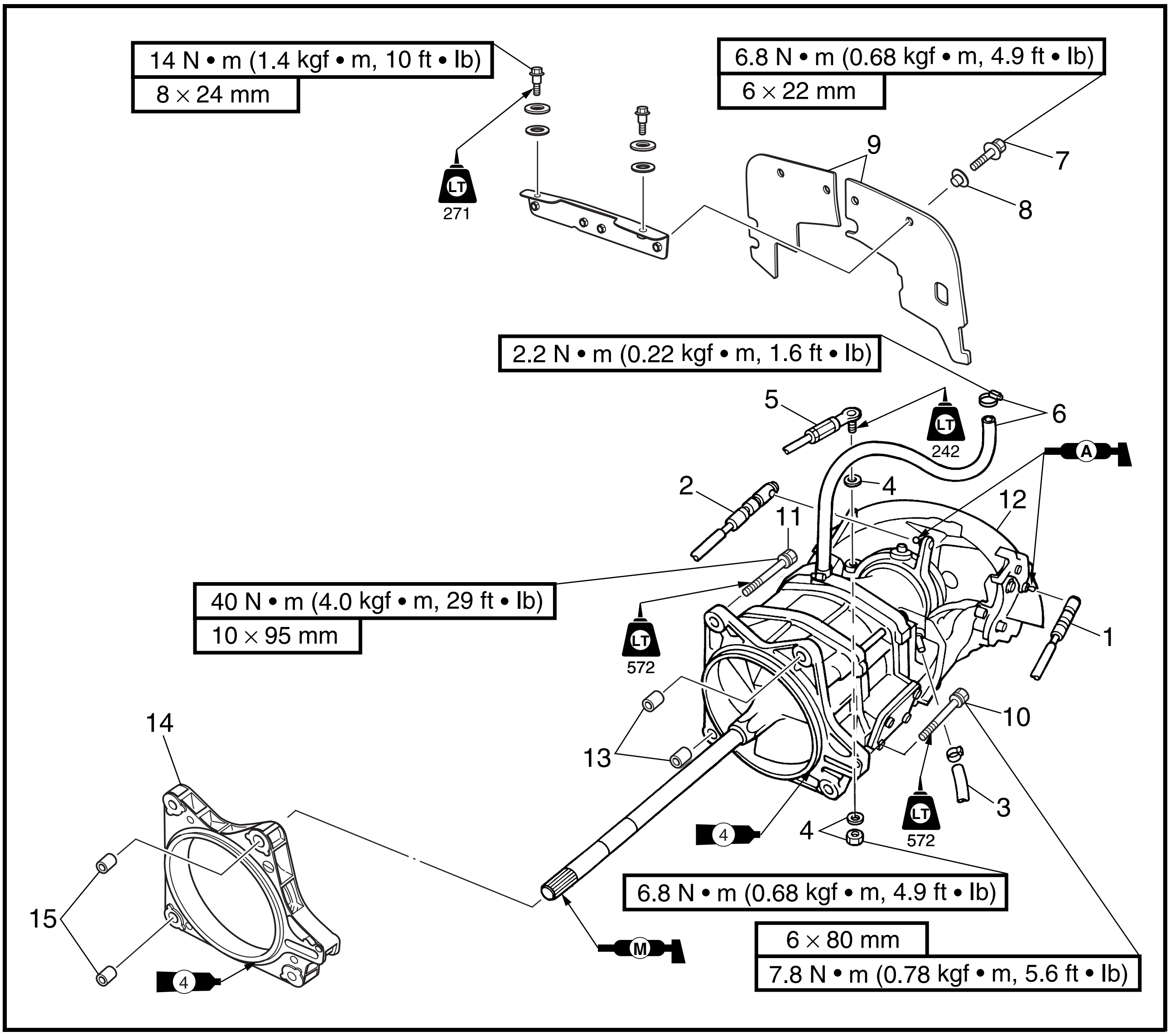
## JET PUMP UNIT
### EXPLODED DIAGRAM




### REMOVAL AND INSTALLATION CHART

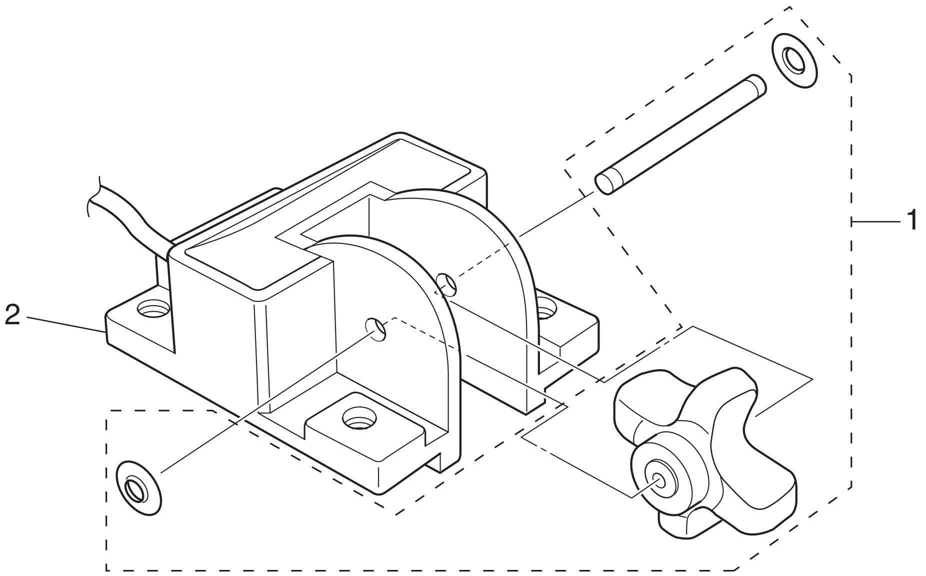
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **JET PUMP UNIT REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Shift cable joint | 1 | |
| 2 | QSTS cable joint | 1 | |
| 3 | Bilge hose | 1 | **NOTE:** Route the speed sensor lead between the jet pump unit and the bilge hose. |
| 4 | Nut/washer | 1/2 | |
| 5 | Steering cable joint | 1 | |
| 6 | Clamp/spout hose | 1/1 | |

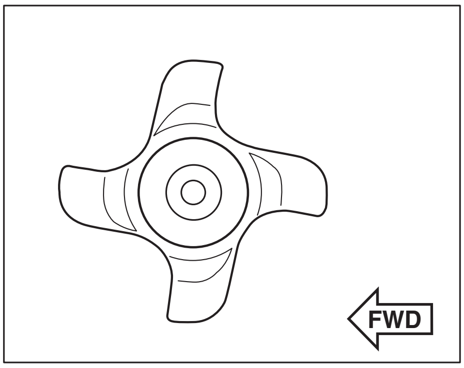
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Bolt | 4 | |
| 8 | Collar | 4 | |
| 9 | Rubber plate | 2 | |
| 10 | Bolt | 1 | |
| 11 | Bolt | 4 | |
| 12 | Jet pump unit assembly | 1 | |
| 13 | Dowel pin | 2 | |
| 14 | Impeller housing 2 | 1 | |
| 15 | Dowel pin | 2 | |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM

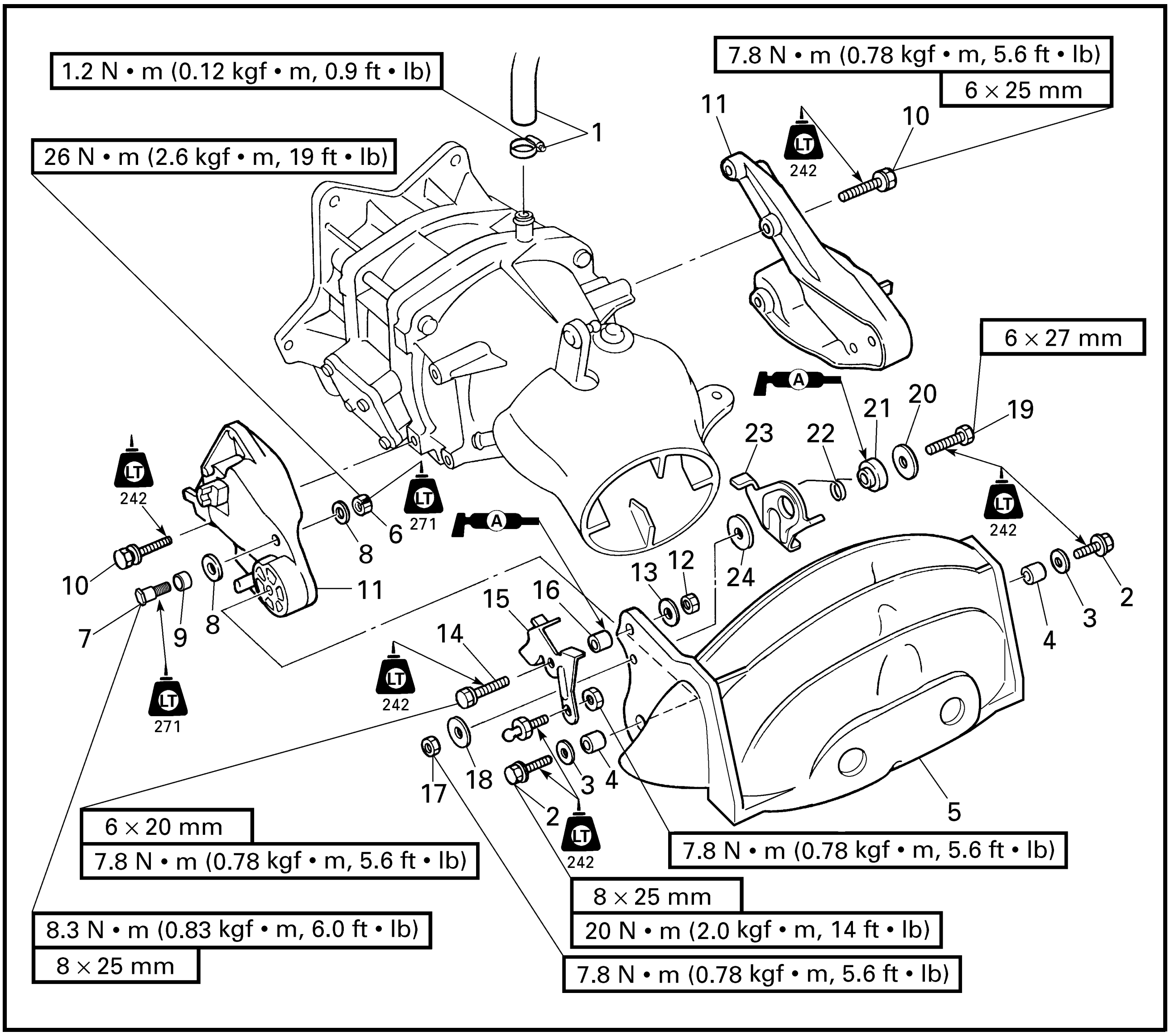



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **SPEED SENSOR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Paddle wheel set | 1 | Not reusable |
| 2 | Speed sensor | 1 | |
| | | | Reverse the disassembly steps for assembly. |

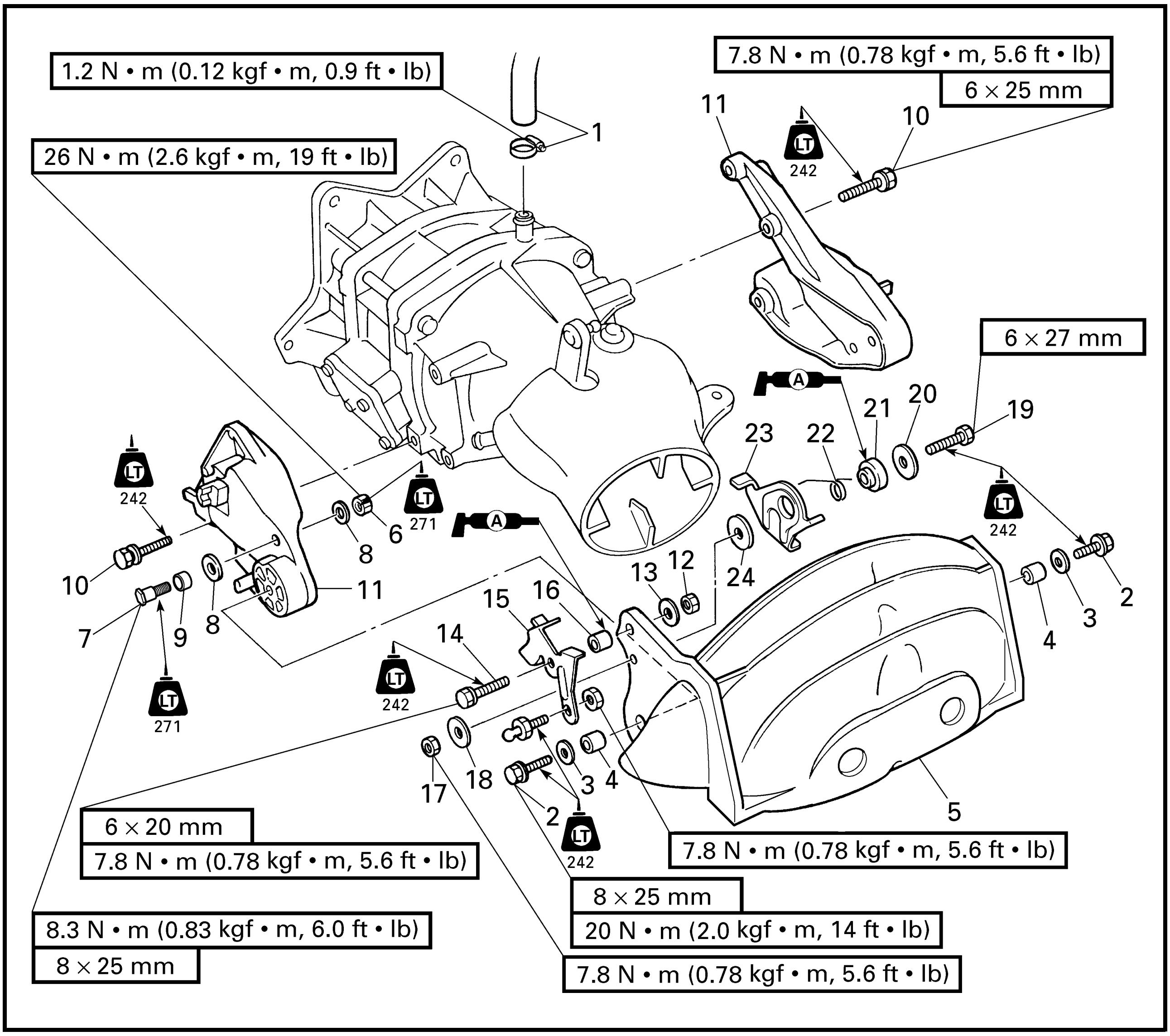
# REVERSE GATE
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

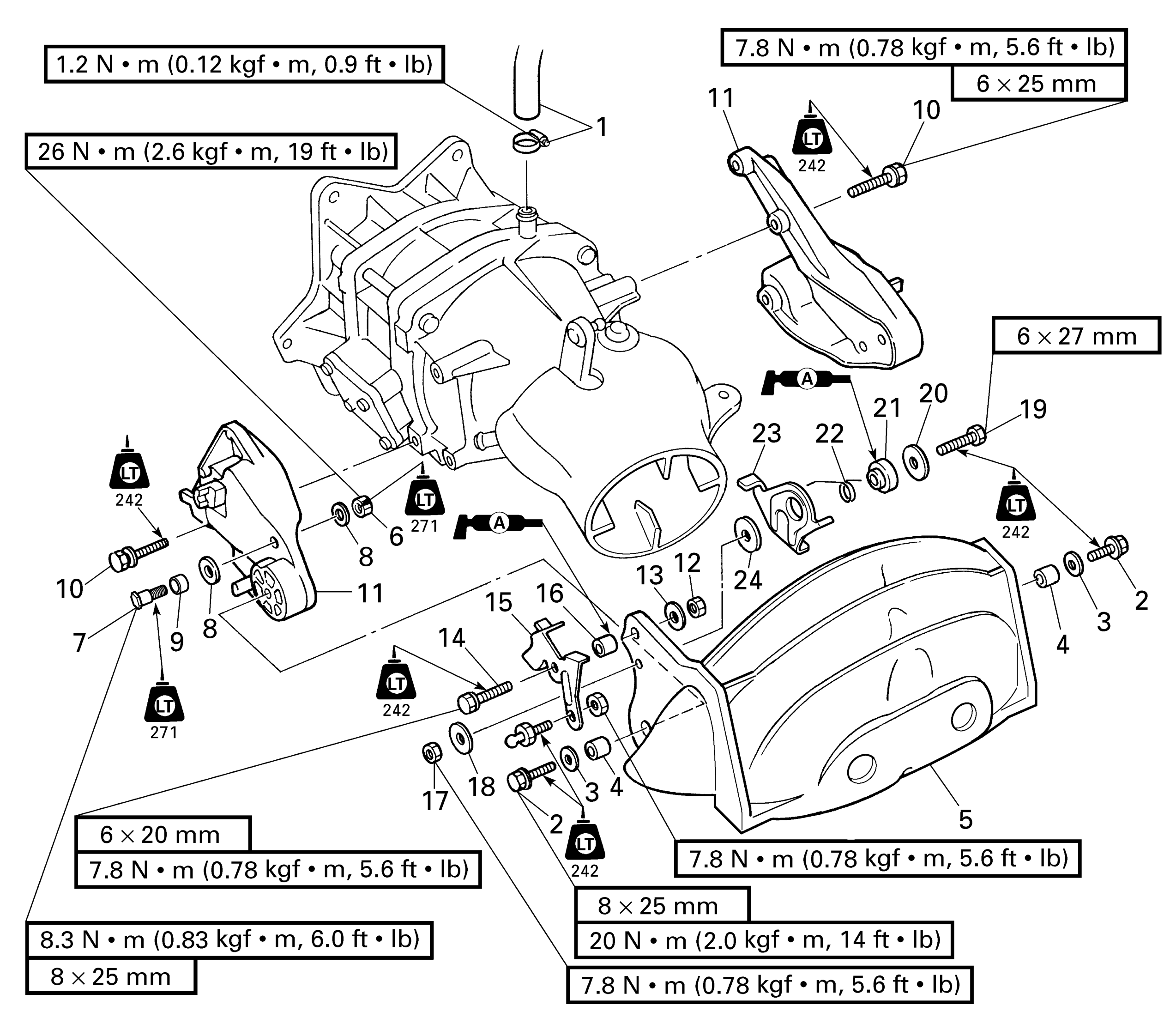
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **REVERSE GATE REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Clamp/spout hose | 1/1 | |
| 2 | Bolt | 2 | |
| 3 | Washer | 2 | |
| 4 | Collar | 2 | |
| 5 | Reverse gate assembly | 1 | |
| 6 | Nut | 1 | |
| 7 | Bolt | 1 | |
| 8 | Washer | 2 | |

## EXPLODED DIAGRAM

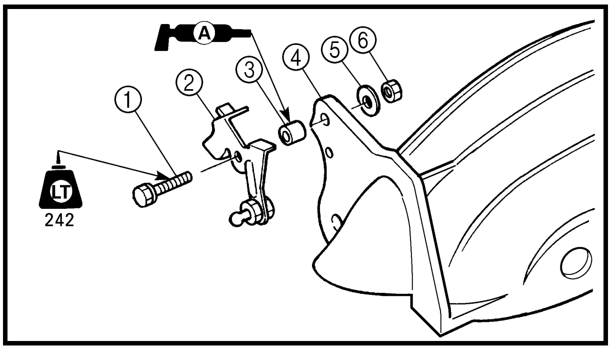



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Roller | 1 | |
| 10 | Bolt | 6 | |
| 11 | Reverse gate stay | 2 | |
| 12 | Nut | 1 | |
| 13 | Washer | 1 | |
| 14 | Bolt | 1 | |
| 15 | Lever 1 | 1 | |
| 16 | Spacer | 1 | |
| 17 | Nut | 1 | |

## EXPLODED DIAGRAM



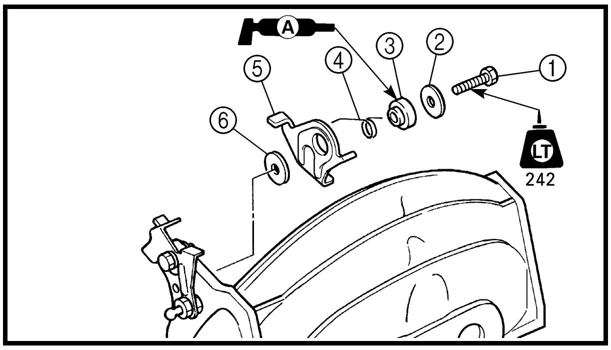

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 18 | Washer | 1 | |
| 19 | Bolt | 1 | |
| 20 | Washer | 1 | |
| 21 | Collar | 1 | |
| 22 | Spring | 1 | |
| 23 | Lever 2 | 1 | |
| 24 | Washer | 1 | |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS

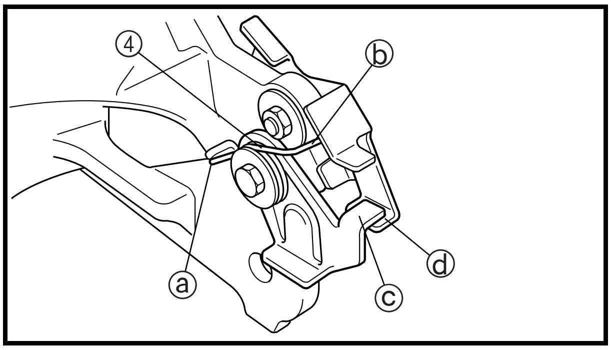
### Lever 1 installation

1. Install:
   - Bolt ①
   - Lever 1 ②
   - Spacer ③
   - Reverse gate ④
   - Washer ⑤
   - Nut ⑥

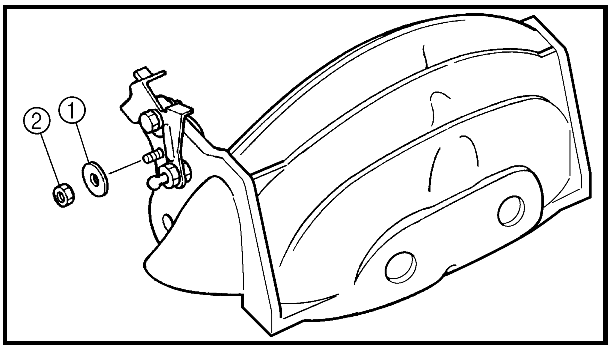



### Lever 2 installation

1. Install:
   - Bolt ①
   - Washer ②
   - Collar ③
   - Spring ④
   - Lever 2 ⑤
   - Washer ⑥



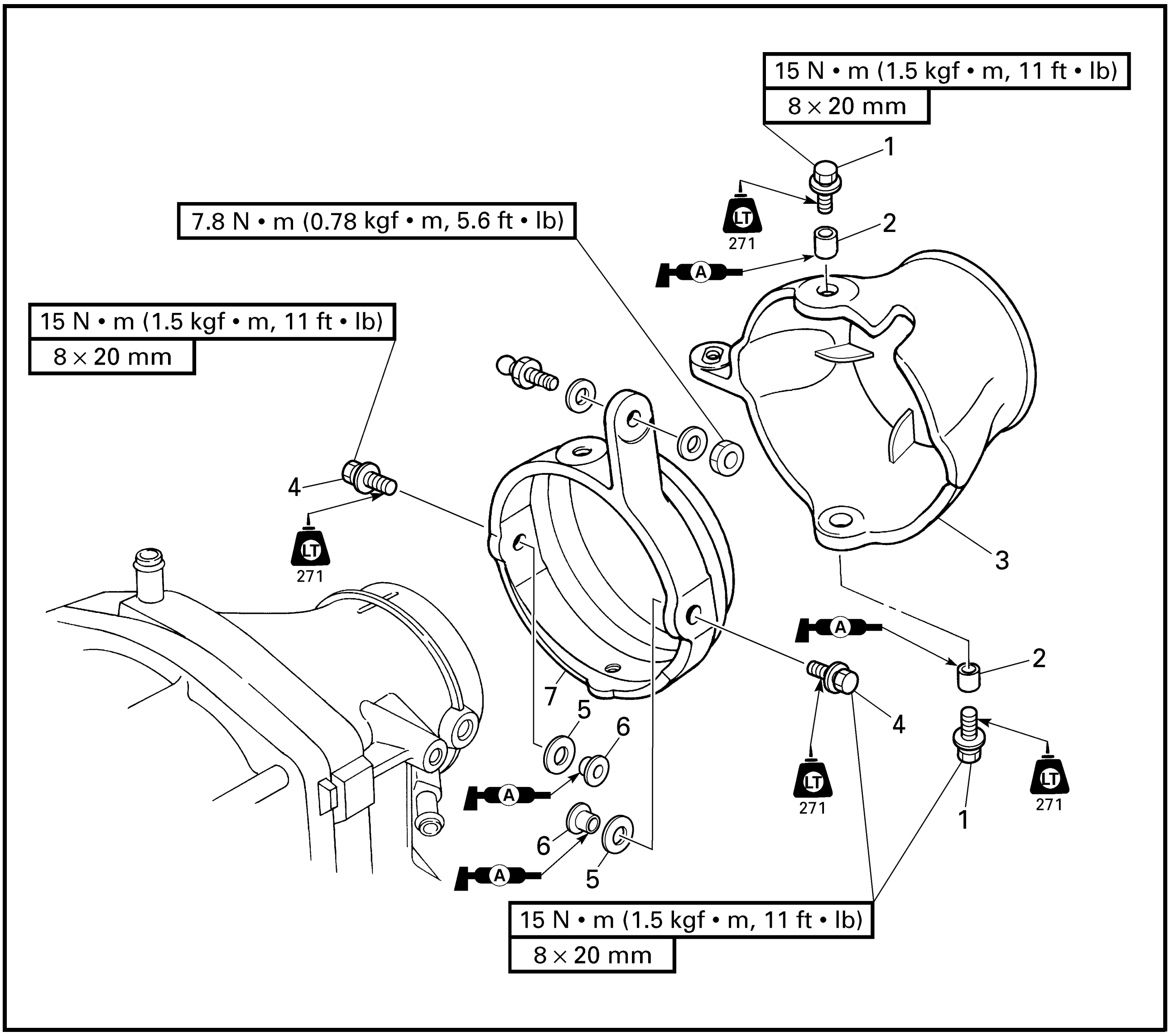

**NOTE:**
- When installing the spring, hook the spring end ⓐ to lever 2 and spring end ⓑ to the reverse gate, as shown in the illustration.
- When installing the lever 2, hook the lever 2 end ⓒ to lever 1 end ⓓ, as shown in the illustration.




2. Install:
   - Washer ①
   - Nut ②

3. Check:
   - Lever 1 and lever 2 movements
     Stick → Reassemble lever 1 and lever 2.

# JET THRUST NOZZLE AND NOZZLE RING
## EXPLODED DIAGRAM

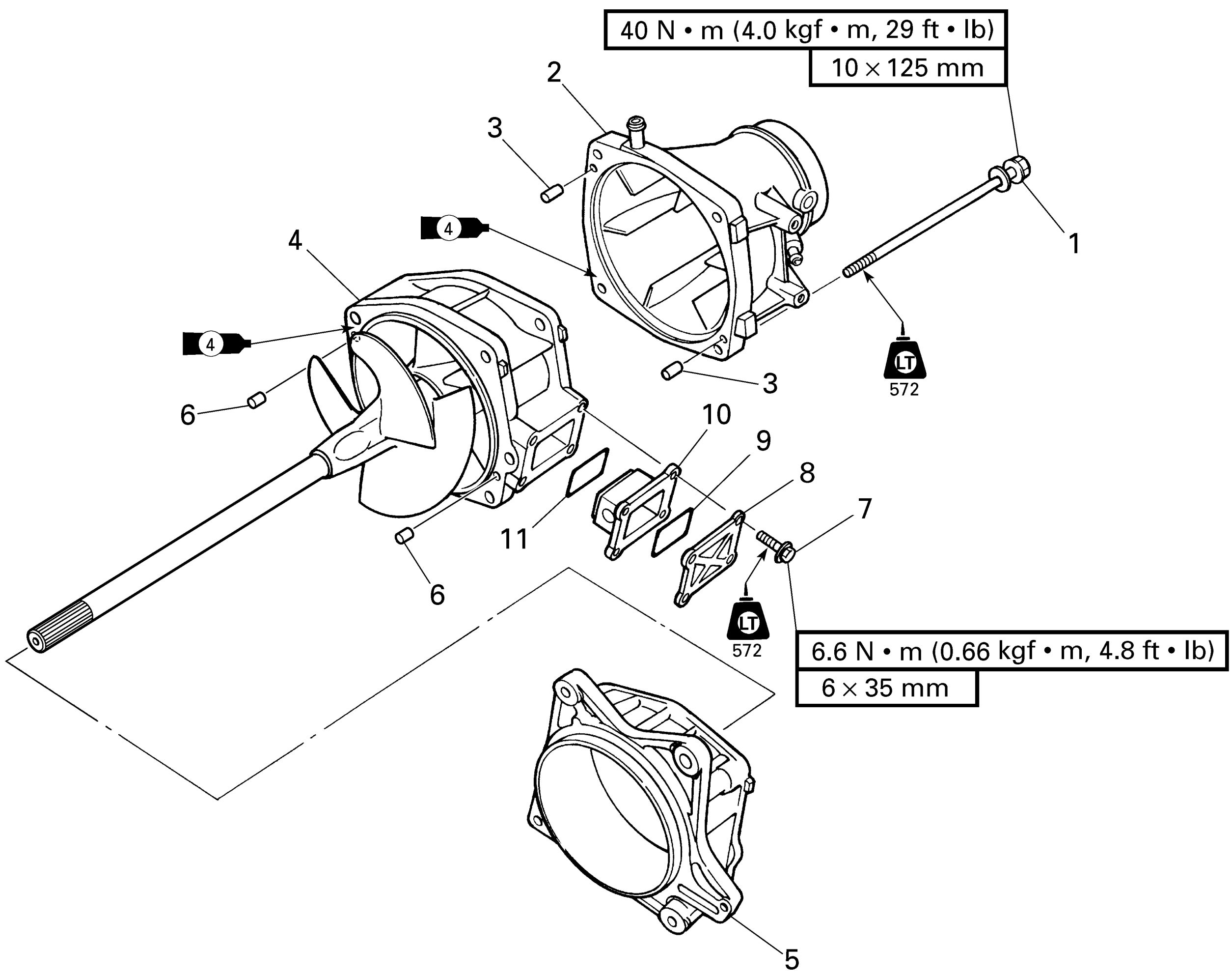



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **JET THRUST NOZZLE AND NOZZLE RING REMOVAL** | | Follow the left "Step" for removal. |
| | Jet pump unit | | Refer to "JET PUMP UNIT". |
| | Reverse gate | | Refer to "REVERSE GATE". |
| 1 | Bolt | 2 | |
| 2 | Collar | 2 | |
| 3 | Jet thrust nozzle | 1 | |
| 4 | Bolt | 2 | |
| 5 | Washer | 2 | |
| 6 | Collar | 2 | |
| 7 | Nozzle ring | 1 | |
| | | | Reverse the removal steps for installation. |

# IMPELLER DUCT AND IMPELLER HOUSING 1

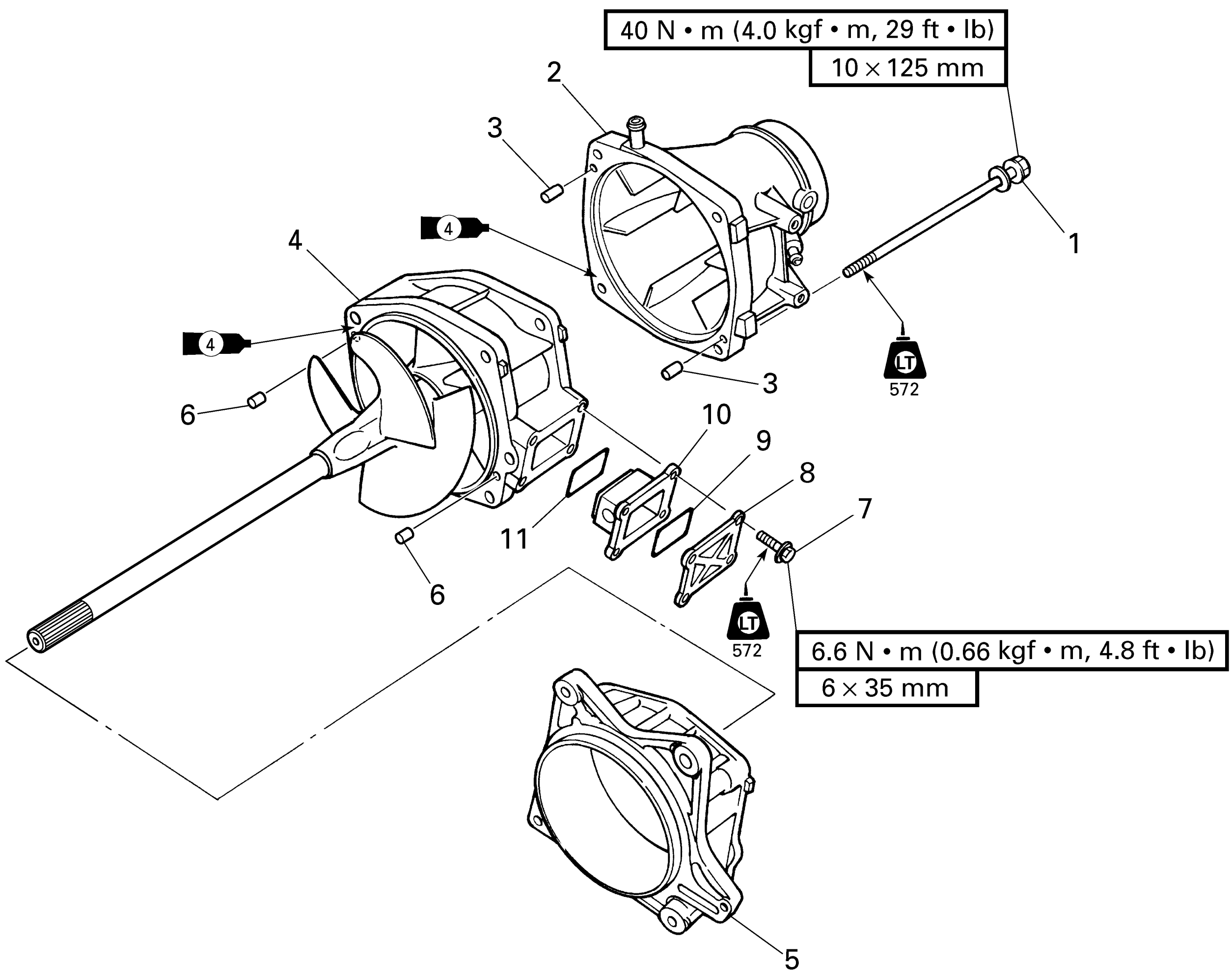
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

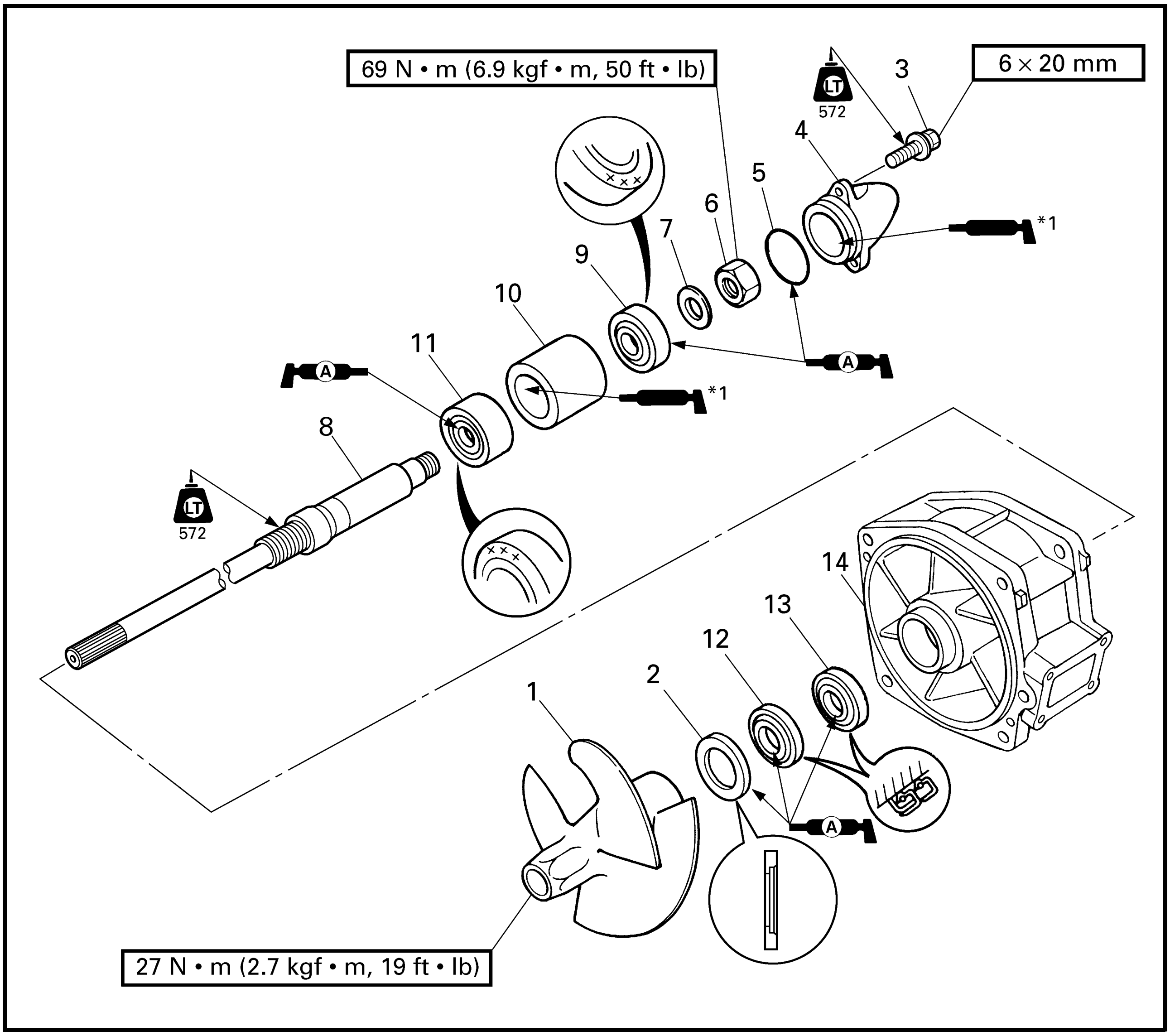
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **IMPELLER DUCT AND IMPELLER HOUSING 1 REMOVAL** | | Follow the left "Step" for removal. |
| | Nozzle ring | | Refer to "JET THRUST NOZZLE AND NOZZLE RING". |
| 1 | Bolt | 4 | |
| 2 | Nozzle | 1 | **NOTE:** |
| 3 | Pin | 2 | Clean the contacting surfaces before applying the Yamabond #4 (Yamaha bond number 4). |
| 4 | Impeller duct assembly | 1 | |
| 5 | Impeller housing 1 | 1 | |
| 6 | Pin | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Bolt | 4 | |
| 8 | Water inlet cover | 1 | |
| 9 | Packing | 1 | |
| 10 | Water inlet strainer | 1 | |
| 11 | Packing | 1 | |
| | | | Reverse the removal steps for installation. |

# IMPELLER DUCT AND DRIVE SHAFT
## EXPLODED DIAGRAM

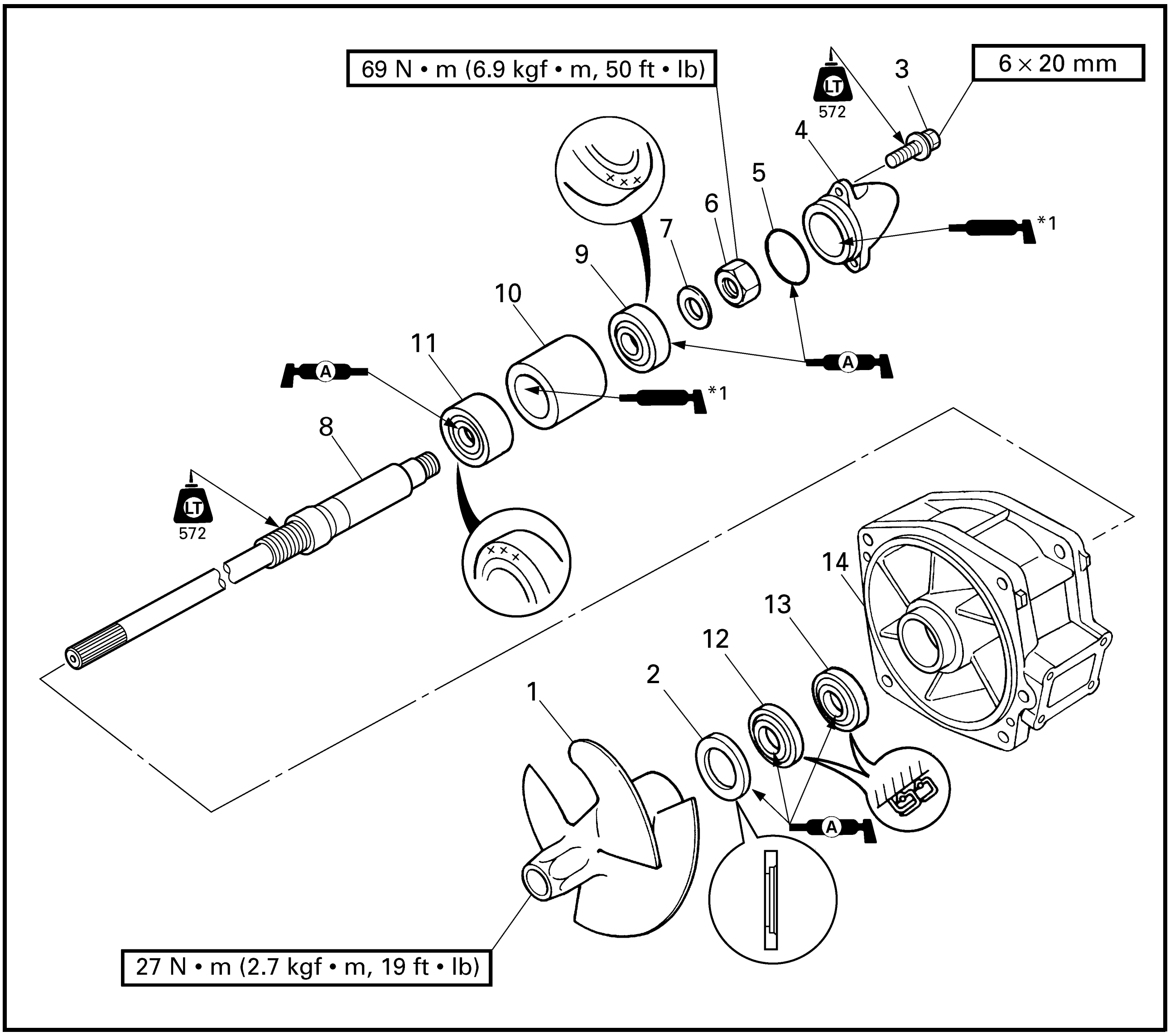



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **IMPELLER DUCT AND DRIVE SHAFT DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Impeller | 1 | Left-hand threads |
| 2 | Spacer | 1 | |
| 3 | Bolt | 3 | |
| 4 | Cap | 1 | |
| 5 | O-ring | 1 | |
| 6 | Nut | 1 | |
| 7 | Washer | 1 | |

*1: EPNOC grease AP #0

## EXPLODED DIAGRAM

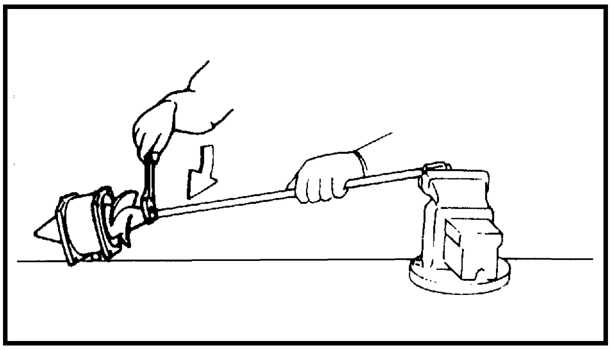



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Drive shaft | 1 | |
| 9 | Rear bearing | 1 | Not reusable |
| 10 | Spacer | 1 | |
| 11 | Front bearing | 1 | Not reusable |
| 12 | Oil seal | 1 | Not reusable |
| 13 | Oil seal | 1 | Not reusable |
| 14 | Impeller duct | 1 | |
| | | | Reverse the disassembly steps for assembly. |

*1: EPNOC grease AP #0

## SERVICE POINTS

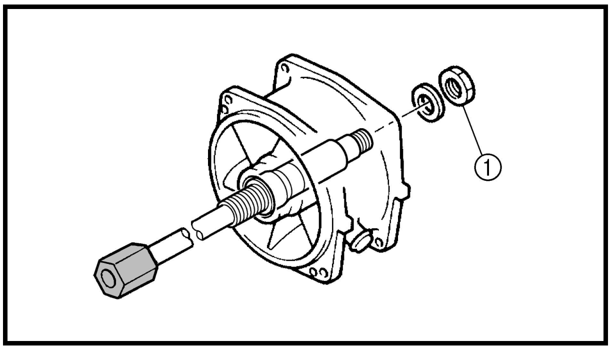
### Drive shaft removal



1. Remove:
   - Impeller

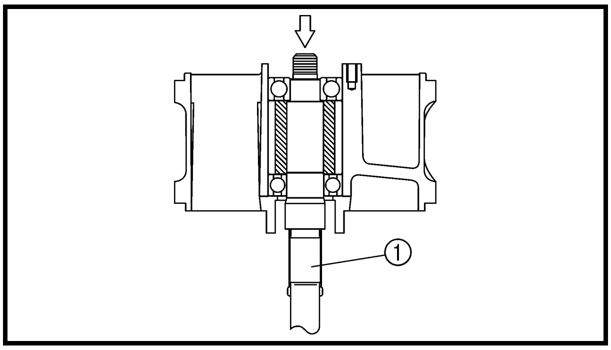
| Drive shaft holder: YB-06151/90890-06519 |
|---|

**NOTE:**
The impeller has left-hand threads. Turn the impeller clockwise to loosen it.




2. Remove:
   - Nut ①

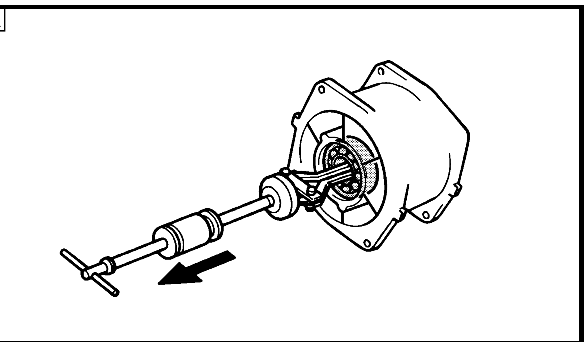
| Drive shaft holder: YB-06151/90890-06519 |
|---|



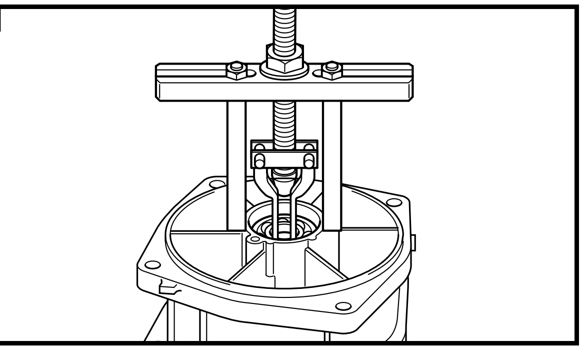

3. Remove:
   - Drive shaft ①

**NOTE:**
Remove the drive shaft with a press.

A



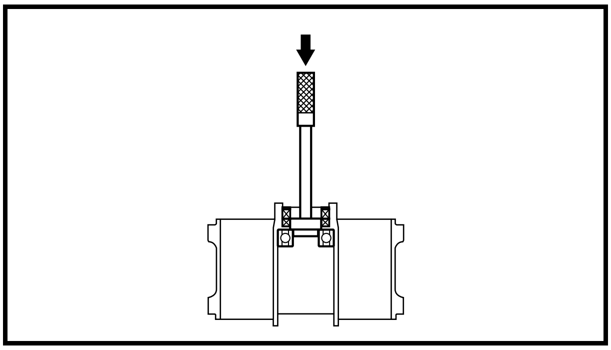
B



4. Remove:
   - Rear bearing

| Slide hammer set: YB-06096<br>Stopper guide plate: 90890-06501<br>Bearing puller: 90890-06535<br>Bearing puller claw 1: 90890-06536<br>Stopper guide stand: 90890-06538 |
|---|

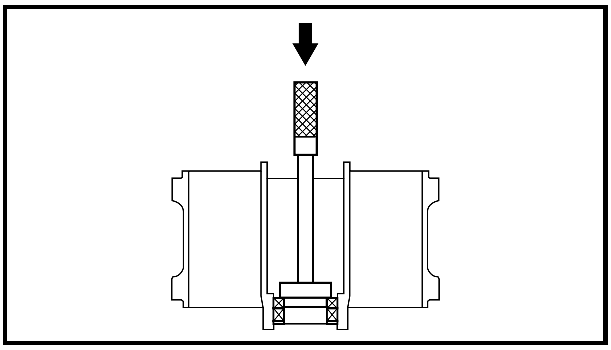
A For USA and Canada
B For worldwide



5. Remove:
   - Front bearing

**Drive rod:**
**YB-06071**
**Driver rod L3:**
**90890-06652**
**Needle bearing attachment:**
**YB-06112/90890-06614**

**NOTE:**
Remove the front bearing with a press.



6. Remove:
   - Oil seal

**Drive rod:**
**YB-06071**
**Driver rod L3:**
**90890-06652**
**Needle bearing attachment:**
**YB-06196/90890-06653**

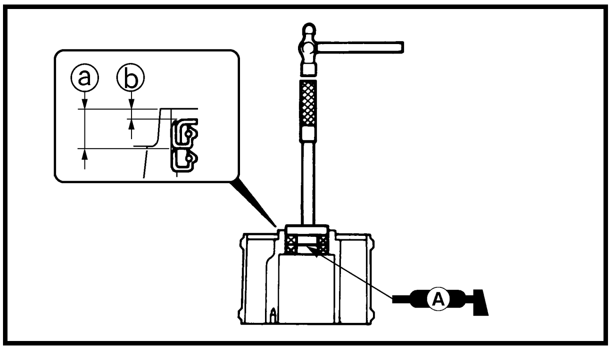
**NOTE:**
Remove the oil seals with press.

**Impeller inspection**

Refer to “JET PUMP UNIT” in Chapter 3.

**Drive shaft inspection**

1. Inspect:
   - Drive shaft
     Damage/wear → Replace.

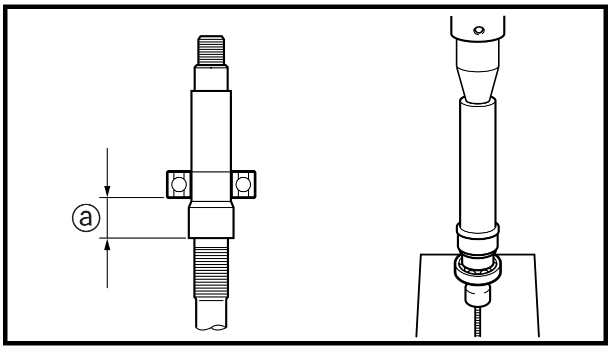



**Drive shaft installation**

1. Install:
   - Oil seals

| | |
|---|---|
| | **Driver rod:**<br>**YB-06071/90890-06606**<br>**Ball bearing attachment:**<br>**YB-06085/90890-06634** |

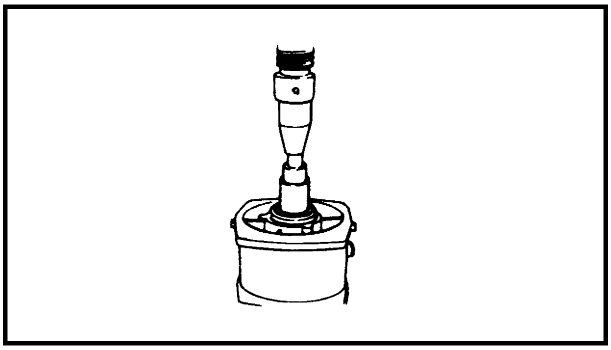
| | |
|---|---|
| | **Distance ⓐ:**<br>**14.2 ± 0.2 mm (0.56 ± 0.01 in)**<br>**Distance ⓑ:**<br>**4.7 ± 0.2 mm (0.19 ± 0.01 in)** |




2. Install:
   - Front bearing
   - Drive shaft

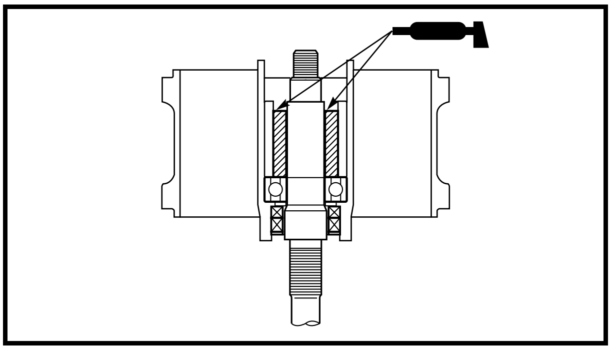
**NOTE:**
Install the front bearing and drive shaft with a press.

| | |
|---|---|
| | **Distance ⓐ:**<br>**23 ± 0.1 mm (0.91 ± 0.004 in)** |



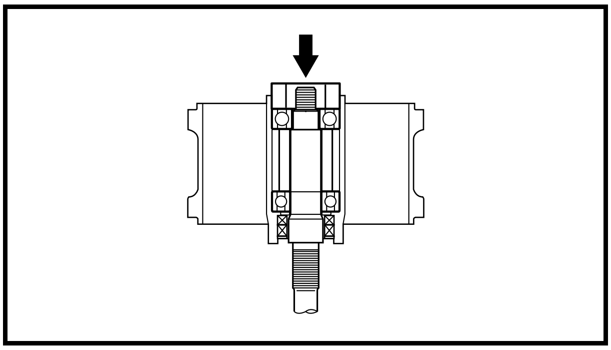
3. Install:
   - Drive shaft (with front bearing)
   - Spacer
   - Impeller duct

**NOTE:**
Press the spacer and the front bearing with a pipe that is more than 33 mm (1.30 in) long, and which has an outer diameter less than 50 mm (1.97 in) and an inner diameter more than 26 mm (1.02 in).



4. Add:
   - EPNOC grease AP #0
     (between the drive shaft and spacer)

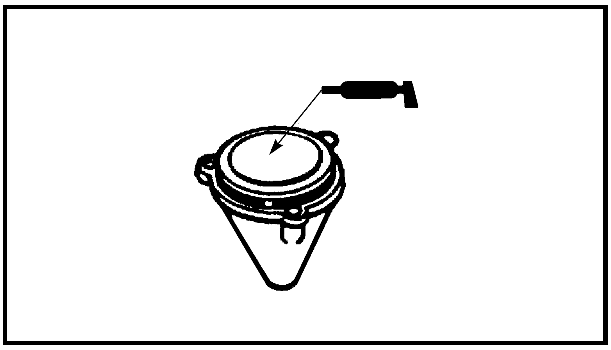
| | |
|---|---|
| | **Quantity:**<br>**Approximately 1/3 of capacity** |



5. Install:
   - Rear bearing

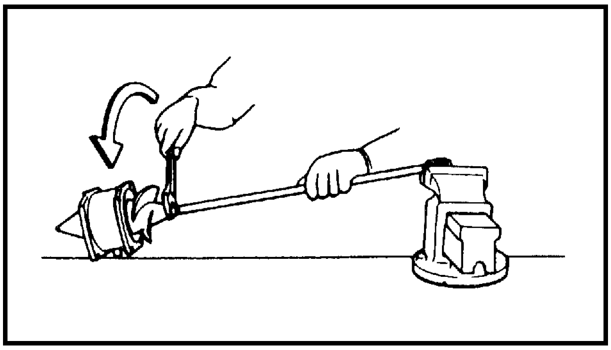
| | |
|---|---|
| | **Bearing inner/outer race attachment:** **YB-34474** |

**NOTE:**
- Press the bearing inner/outer race at the same time holding the drive shaft and impeller duct.
- If a bearing inner/outer race attachment is not available, use a washer or pipe with an outer diameter of 46 mm (1.81 in) and an inner diameter of 20 mm (0.79 in).



6. Add:
   - EPNOC grease AP #0 (into the cap)

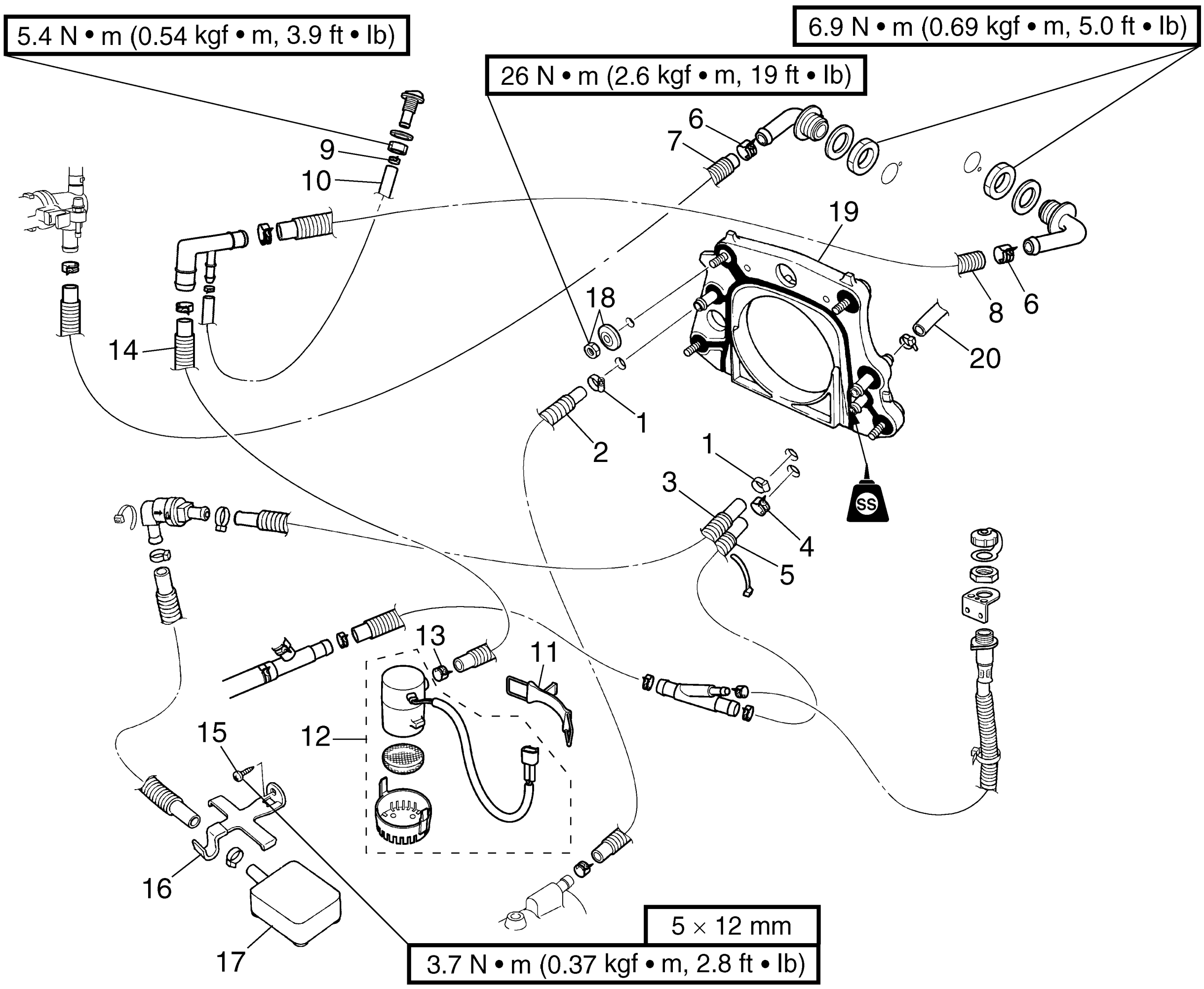
| | |
|---|---|
| | **Quantity:** **Approximately 1/3 of capacity** |



7. Install:
   - Nut
   - Impeller

| | |
|---|---|
| | **Drive shaft holder:** **YB-06151/90890-06519** |

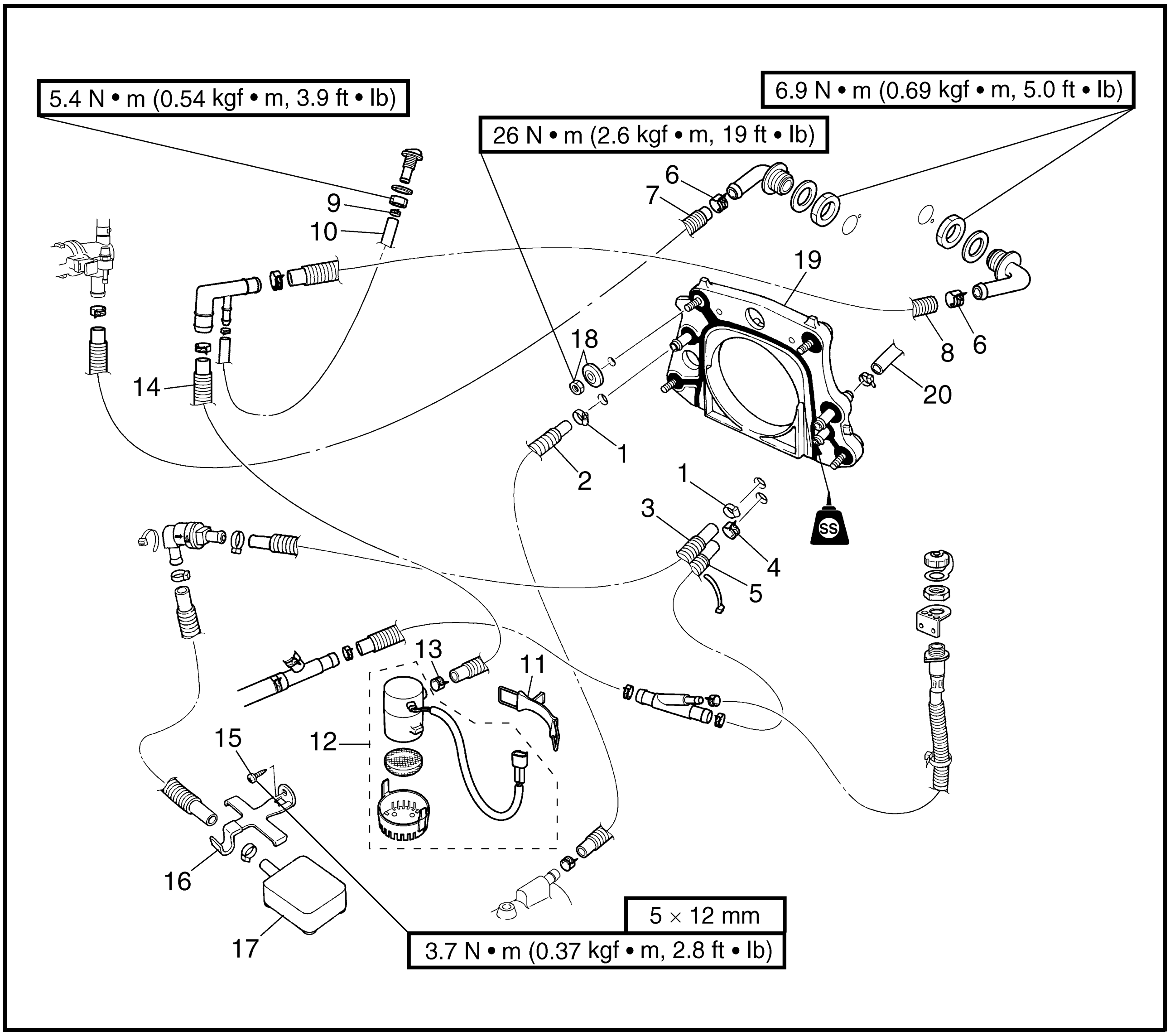
# TRANSOM PLATE AND HOSES
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

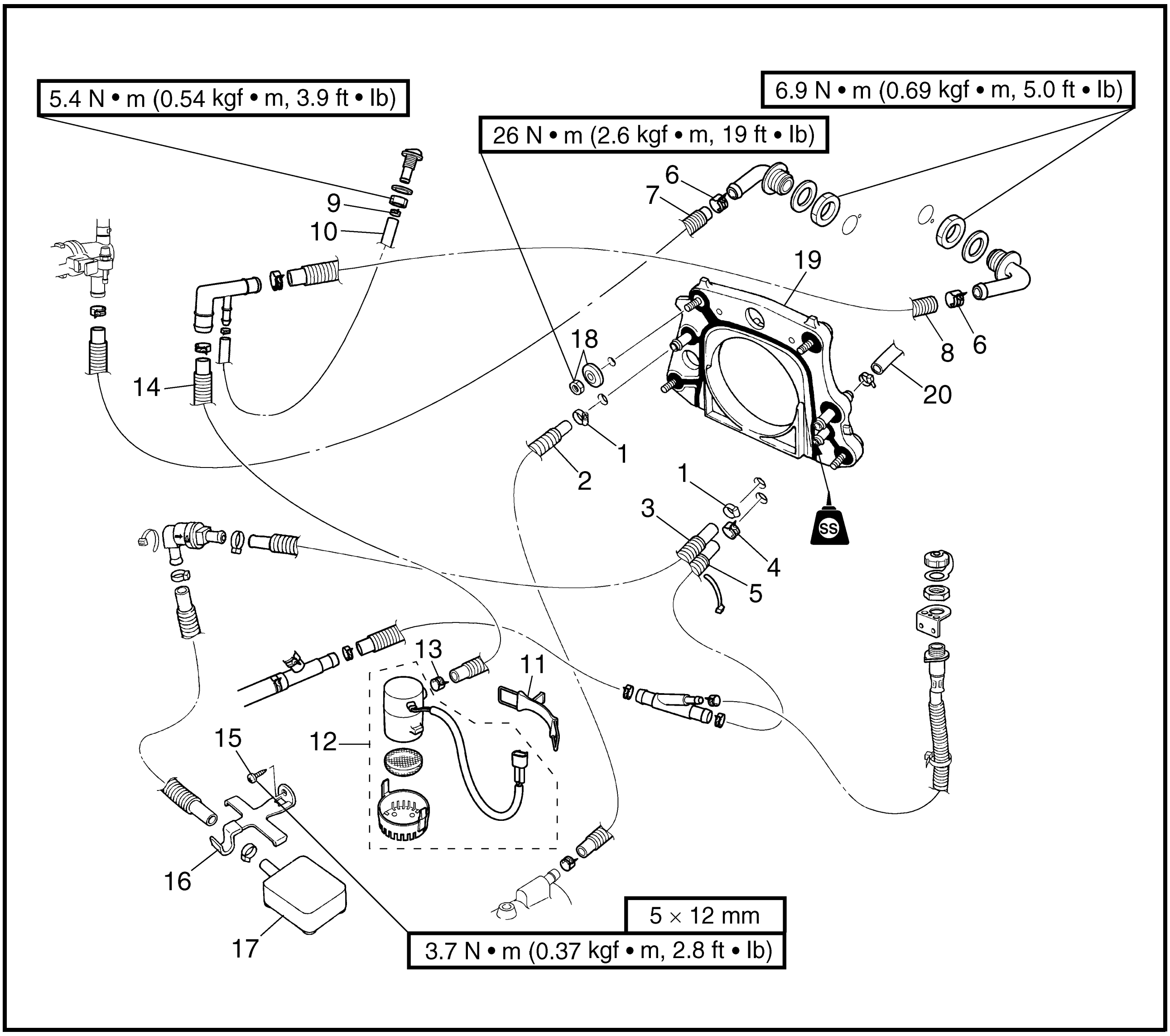
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **TRANSOM PLATE AND HOSES REMOVAL** | | Follow the left "Step" for removal. |
| | Exhaust system | | Refer to "EXHAUST SYSTEM" in Chapter 8. |
| | Jet pump unit assembly | | Refer to "JET PUMP UNIT". |
| 1 | Hose clamp | 2 | |
| 2 | Cooling water hose | 1 | Cooling water outlet (exhaust pipe) |
| 3 | Bilge hose 1 | 1 | **NOTE:** Route the bilge hose 1 under the drive shaft tube. |
| 4 | Hose clamp | 1 | |
| 5 | Cooling water hose | 1 | Cooling water inlet |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Hose clamp | 2 | |
| 7 | Cooling water hose | 1 | Cooling water outlet (thermostat) |
| 8 | Bilge hose 2 | 1 | |
| 9 | Hose clamp | 1 | |
| 10 | Bilge hose 3 | 1 | |
| 11 | Band | 1 | |
| 12 | Electric bilge pump assembly | 1 | |
| 13 | Hose clamp | 1 | |
| 14 | Bilge hose 4 | 1 | |
| 15 | Screw | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 16 | Bilge strainer holder | 1 | |
| 17 | Bilge strainer | 1 | |
| 18 | Nut/washer | 4/4 | |
| 19 | Transom plate | 1 | |
| 20 | Bilge hose 5 | 1 | |
| | | | Reverse the removal steps for installation. |

## SERVICE POINTS

### Bilge strainer inspection

Refer to “JET PUMP UNIT” in Chapter 3.

### Electric bilge pump inspection

Refer to “BILGE PUMP” in Chapter 3.
Refer to “ELECTRIC BILGE PUMP” in Chapter 7.

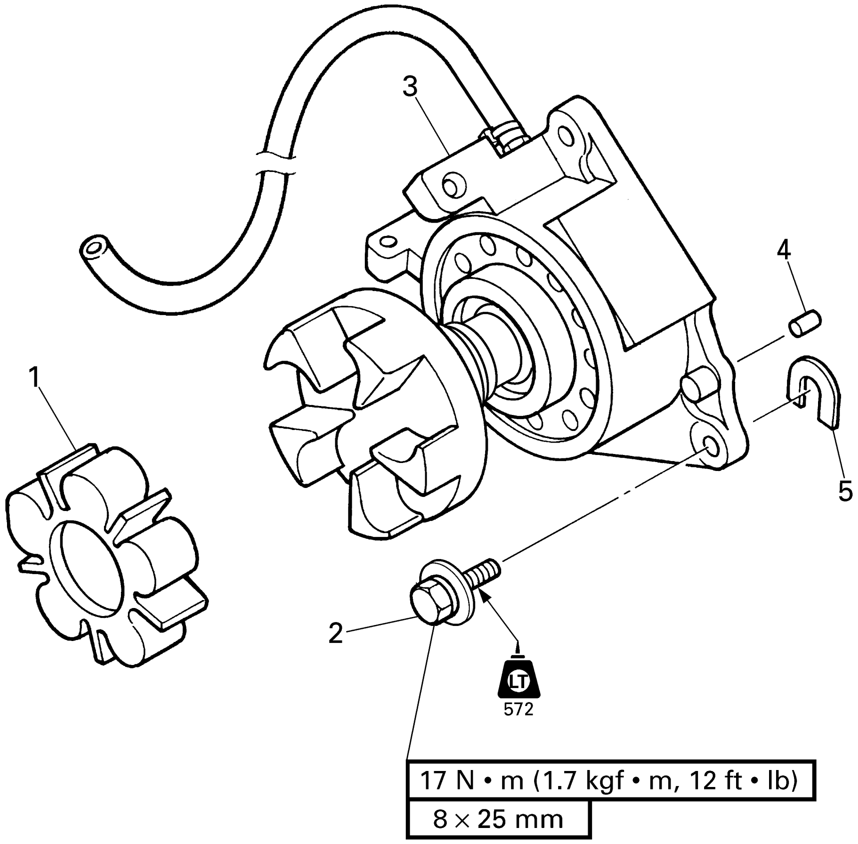
### Bilge hose inspection

1. Inspect:
   - Bilge hoses
     Cracks/damage/wear → Replace.

### Cooling water hose inspection

1. Inspect:
   - Cooling water hoses
     Cracks/damage/wear → Replace.

# BEARING HOUSING
## EXPLODED DIAGRAM

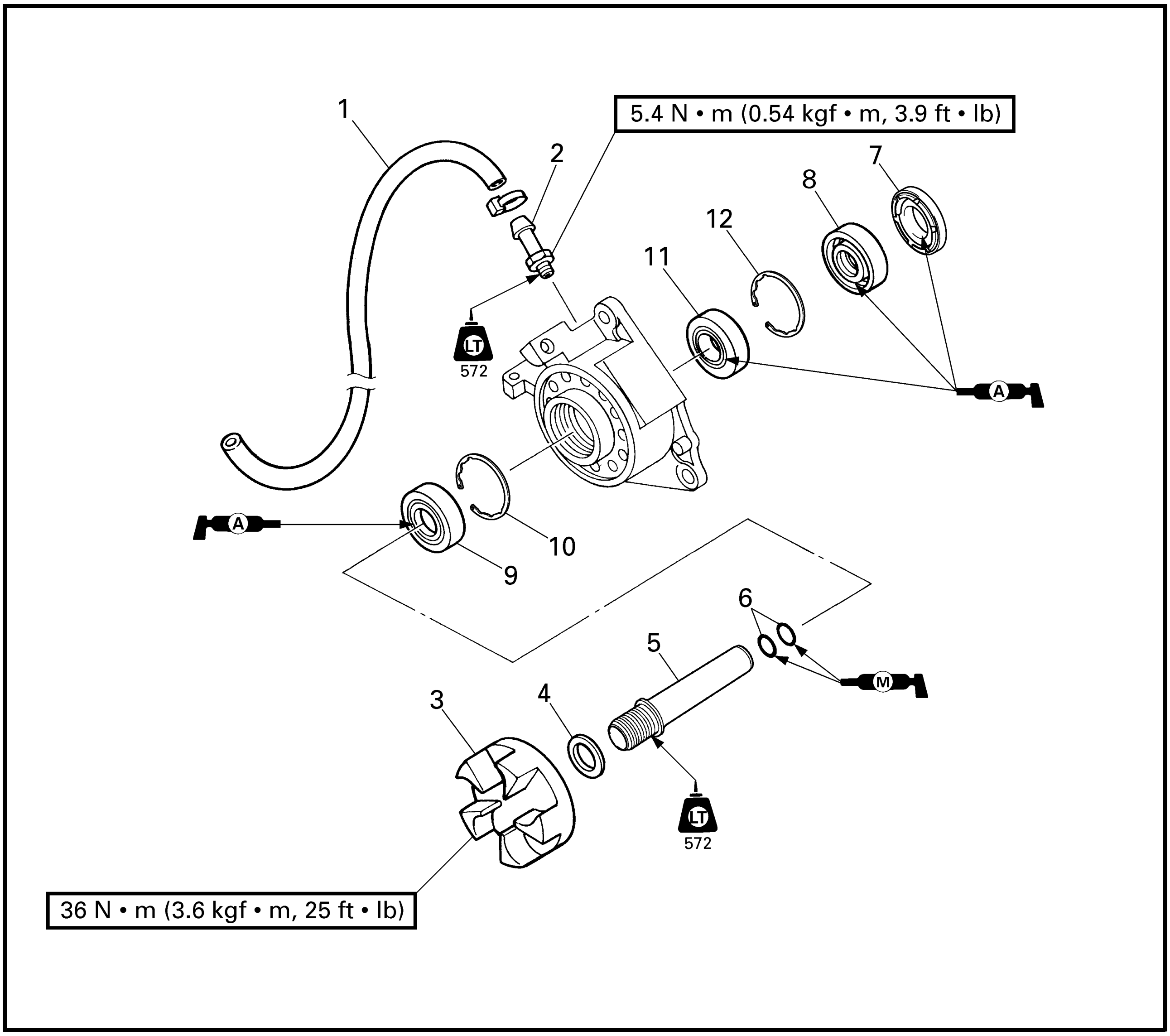



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **BEARING HOUSING REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT" in Chapter 5. |
| 1 | Rubber coupling | 1 | |
| 2 | Bolt | 3 | |
| 3 | Intermediate housing assembly | 1 | |
| 4 | Pin | 2 | |
| 5 | Shim | * | **NOTE:** Install the shims in their original locations. |
| | | | Reverse the removal steps for installation. |

*: As required

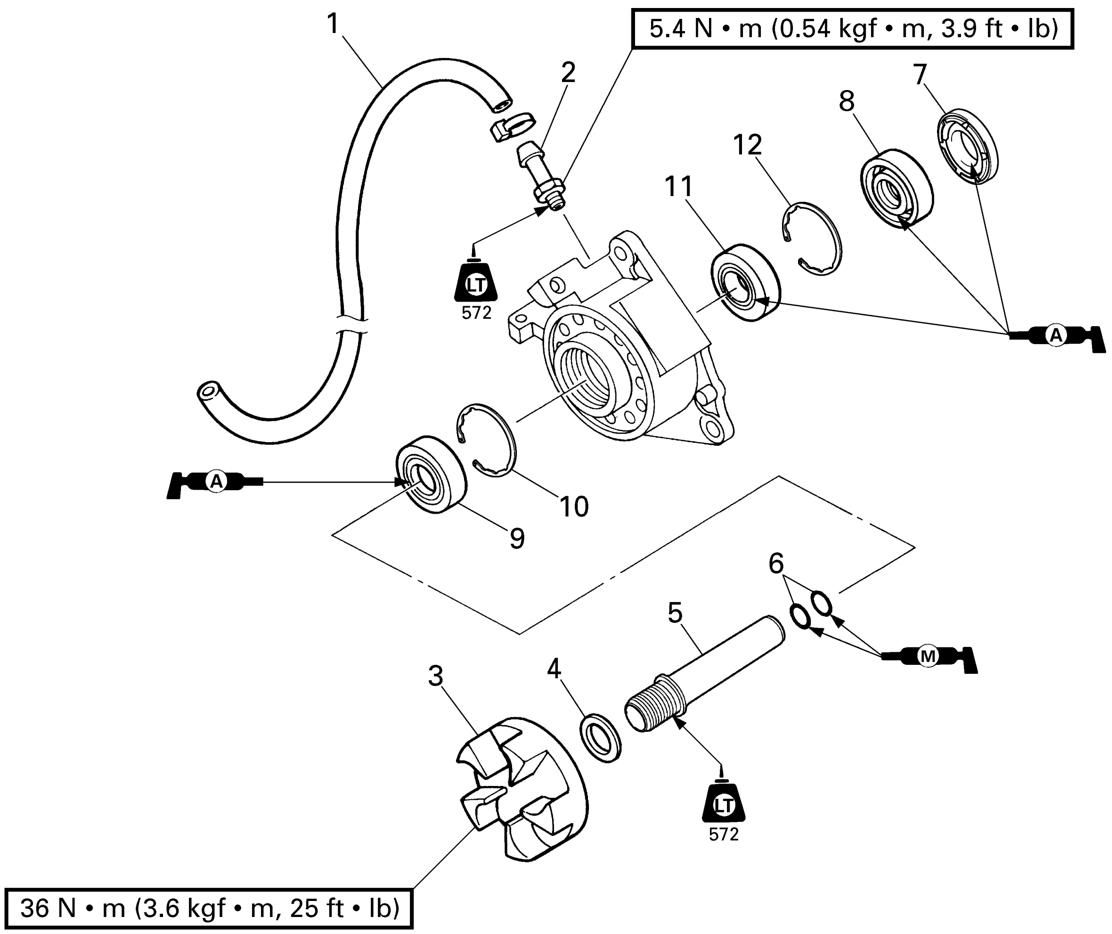
## EXPLODED DIAGRAM



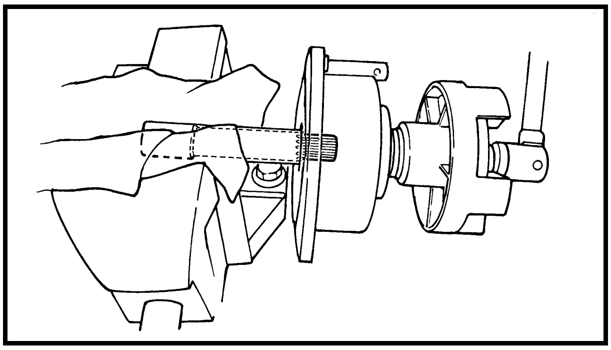

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **BEARING HOUSING DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Grease hose | 1 | |
| 2 | Nipple | 1 | |
| 3 | Driven coupling | 1 | |
| 4 | Washer | 1 | |
| 5 | Intermediate drive shaft | 1 | |
| 6 | O-ring | 2 | |

## EXPLODED DIAGRAM



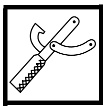

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Oil seal | 1 | **Not reusable** |
| 8 | Oil seal | 1 | **Not reusable** |
| 9 | Oil seal | 1 | **Not reusable** |
| 10 | Circlip | 1 | |
| 11 | Bearing | 1 | **Not reusable** |
| 12 | Circlip | 1 | |
| | | | Reverse the disassembly steps for assembly. |



## SERVICE POINTS

**Driven coupling removal and installation**

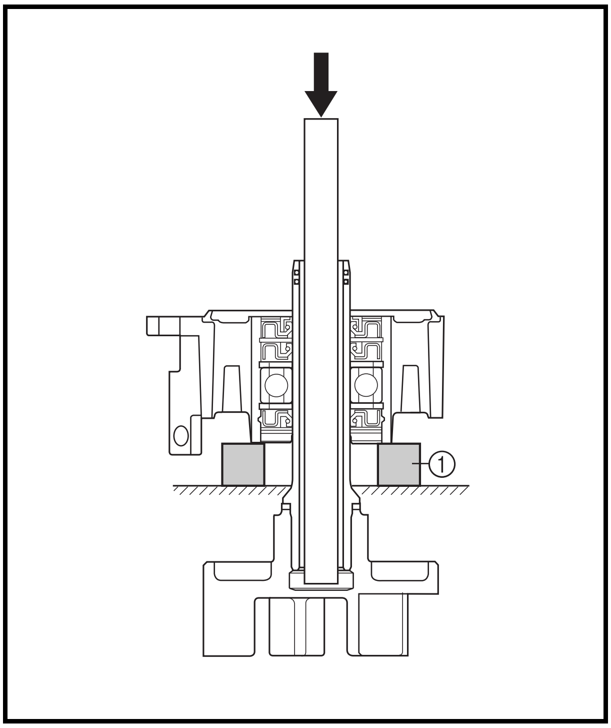
1. Remove and install:
   - Driven coupling



**Coupler wrench:**
**YW-06551/90890-06551**
**Shaft holder:**
**YB-06552/90890-06552**

**NOTE:**

- Install the driven coupling with the same special tools that were used for removal.
- Check that the shaft holder and intermediate drive shaft are properly engaged.




**Intermediate drive shaft removal**

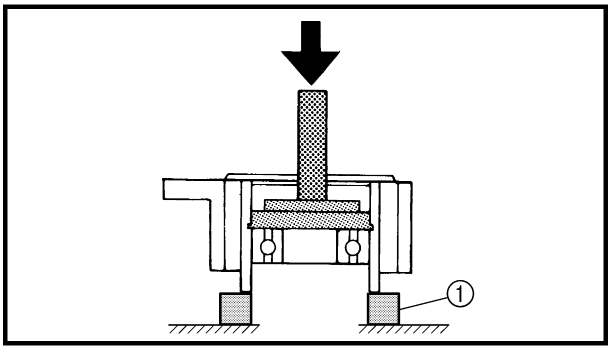
1. Remove:
   - Intermediate drive shaft

**Removal steps:**

- Temporarily install the driven coupling to the intermediate drive shaft.
- Insert a long rod to the driven coupling shaft.
- Press out the intermediate drive shaft by pushing the rod.

**NOTE:**

Support the intermediate housing with steel blocks ① and press the driven coupling shaft with a rod that is more than 210 mm (8.27 in) long, and which has an outer diameter less than 16 mm (0.63 in).

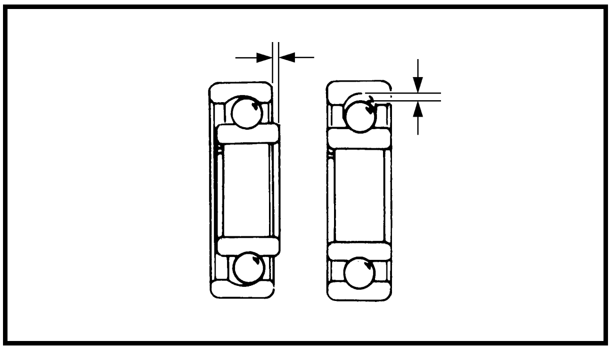



### Bearing removal

1. Remove:
   - Bearing

**Driver rod:**
**YB-06071/90890-06606**
**Bearing outer race attachment:**
**YB-06156/90890-06626**

**NOTE:**
- Install the bearing with the same special tools that were used for removal.
- Support the intermediate housing with steel blocks ① and press the bearing.

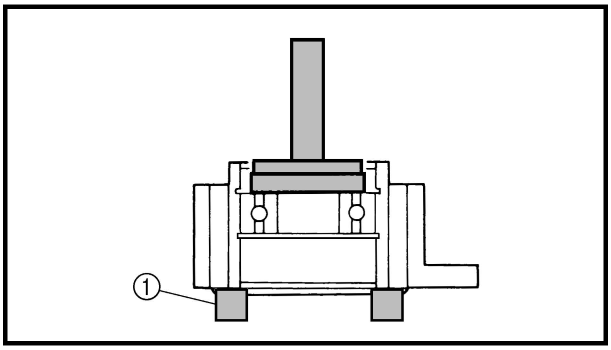


### Bearing, intermediate drive shaft, and grease hose inspection

1. Inspect:
   - Bearing
     Rotate the inner race by hand.
     Damage/rough movement → Replace.
   - Intermediate drive shaft
     Damage/pitting → Replace.
   - Grease hose
     Cracks/wear → Replace.

### Driven coupling inspection

1. Inspect:
   - Driven coupling
   - Driven coupling damper
     Damage/wear → Replace.

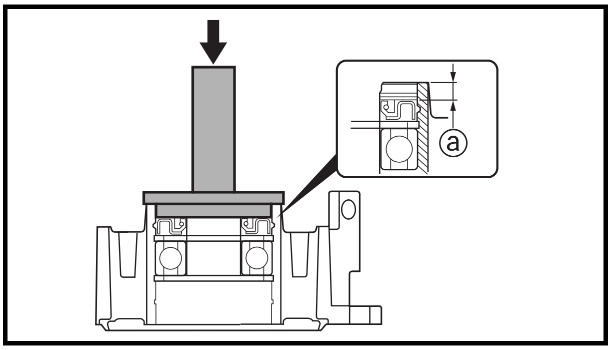



### Bearing installation

1. Install:
   - Circlip (rear)
2. Install:
   - Bearing

**Driver rod:**
**YB-06071/90890-06606**
**Bearing outer race attachment:**
**YB-06156/90890-06626**

**NOTE:**
Support the intermediate housing with steel blocks ① and press the bearing.



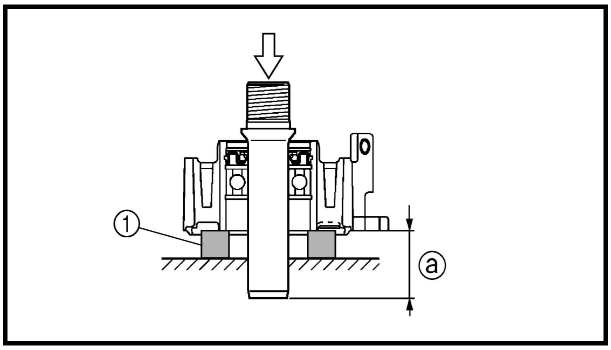

### Oil seal installation

1. Install:
   - Oil seal

**Driver rod:**
**YB-06071/90890-06606**
**Bearing outer race attachment:**
**YB-06156/90890-06626**

**NOTE:**
Before installing the oil seal, lubricate the clip glove with water resistant grease.

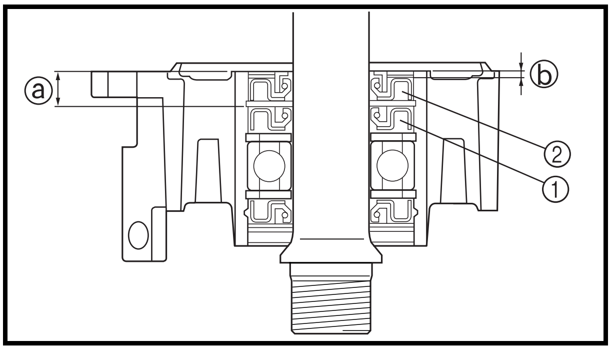
**Distance ⓐ:**
**6.8–7.2 mm (0.27–0.28 in)**




2. Install:
   - Intermediate drive shaft

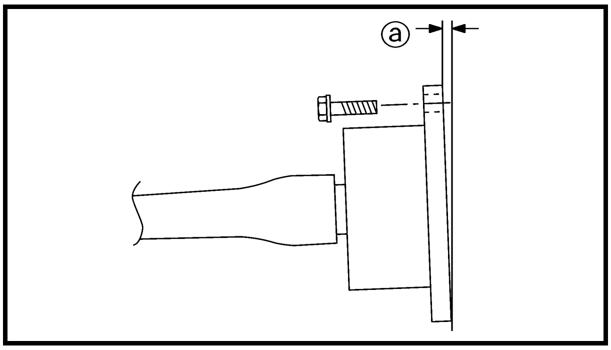
**Distance ⓐ:**
**45.5–46.5 mm (1.79–1.83 in)**

**NOTE:**
Support the intermediate housing with steel blocks ① and press the driven coupling shaft.




3. Install:
   - Oil seal ① [8 mm (0.31 in)]
   - Oil seal ② [11 mm (0.43 in)]

**Distance ⓐ:**
**10.3–10.7 mm (0.41–0.42 in)**
**Distance ⓑ:**
**0.6–1.0 mm (0.02–0.04 in)**




**Intermediate housing installation**

1. Install:
   - Intermediate housing
   - Shim

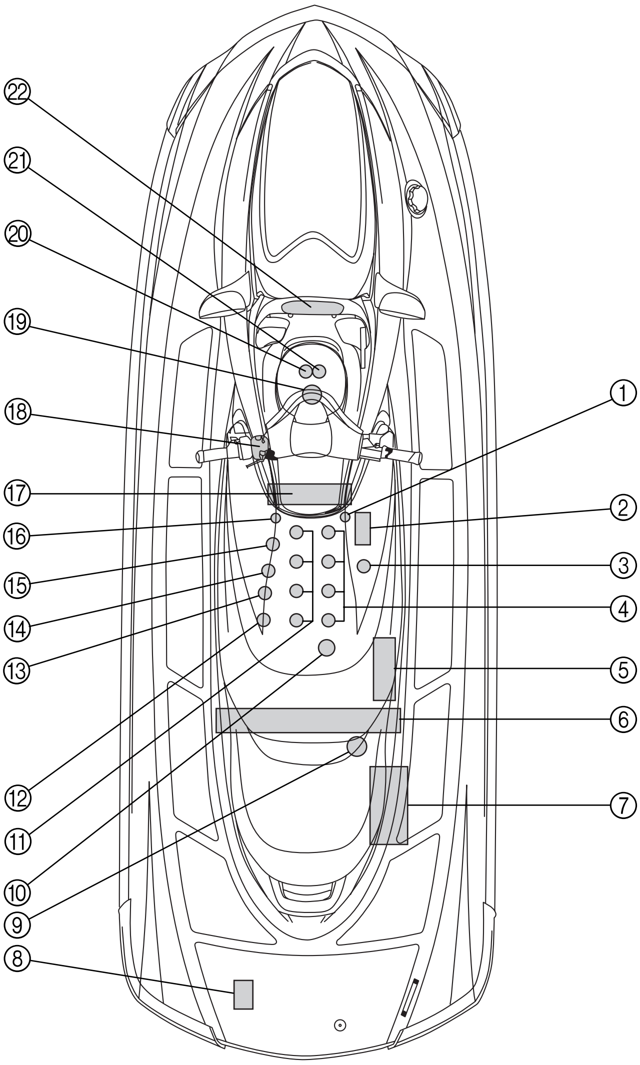
**Installation steps:**
- Install the intermediate housing.
- Measure the clearance ⓐ at each bolt hole.
- Install the suitable shim from the table below.

| Clearance ⓐ | Shim thickness |
|---|---|
| 0–0.2 mm (0–0.008 in) | No need |
| 0.3–0.7 mm (0.012–0.028 in) | 0.5 mm |
| 0.8–1.2 mm (0.031–0.047 in) | 1.0 mm |
| 1.3–2.0 mm (0.051–0.079 in) | 1.5 mm |

**NOTE:**
Install the shim(s) to the original position if the intermediate housing is not replaced.

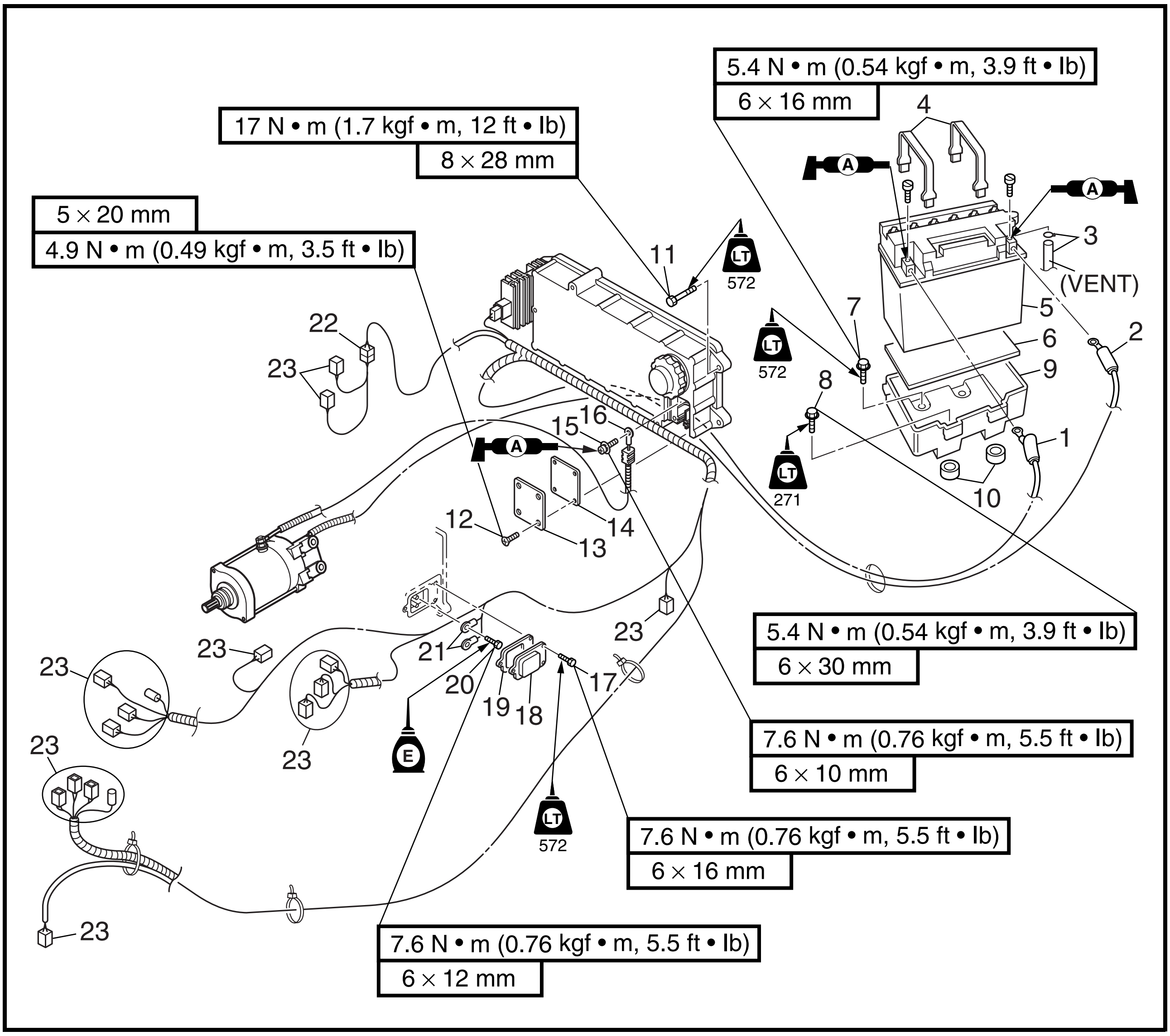
# CHAPTER 7
# ELECTRICAL SYSTEM

## ELECTRICAL COMPONENTS




① Thermoswitch (engine)
② Starter motor
③ Engine temperature sensor
④ Spark plugs
⑤ Ignition coils
⑥ Electrical box
⑦ Battery
⑧ Speed sensor
⑨ Electric bilge pump
⑩ Cam position sensor
⑪ Fuel injectors
⑫ Thermoswitch (exhaust)
⑬ Oil pressure switch
⑭ Intake air pressure sensor
⑮ Intake air temperature sensor
⑯ Throttle position sensor
⑰ Lighting coil and pulser coil
⑱ Engine stop switch, engine shut-off switch and start switch
⑲ Buzzer
⑳ Fuel pump
㉑ Fuel sender
㉒ Multifunction meter

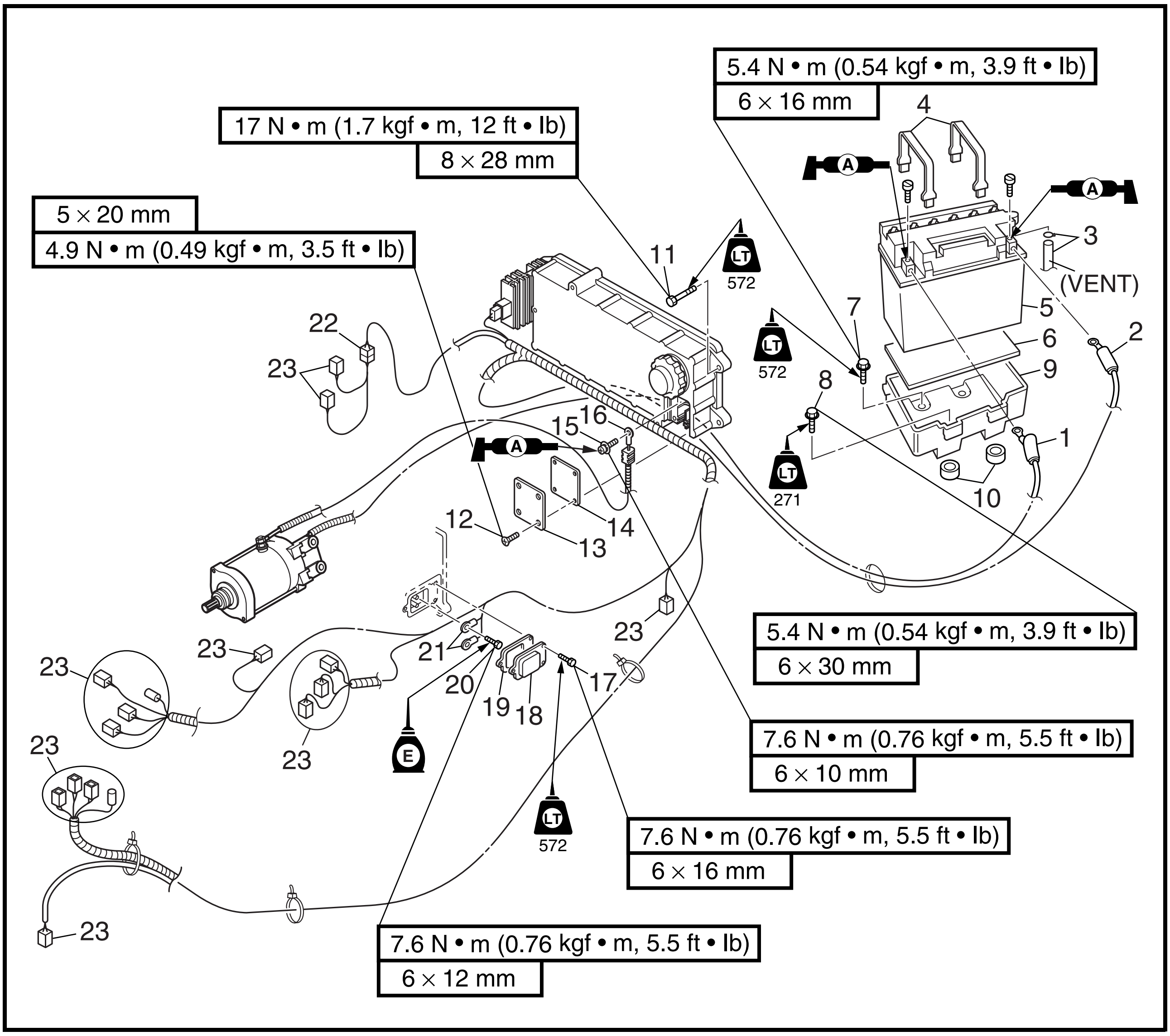
# ELECTRICAL BOX AND IGNITION COIL BOX
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

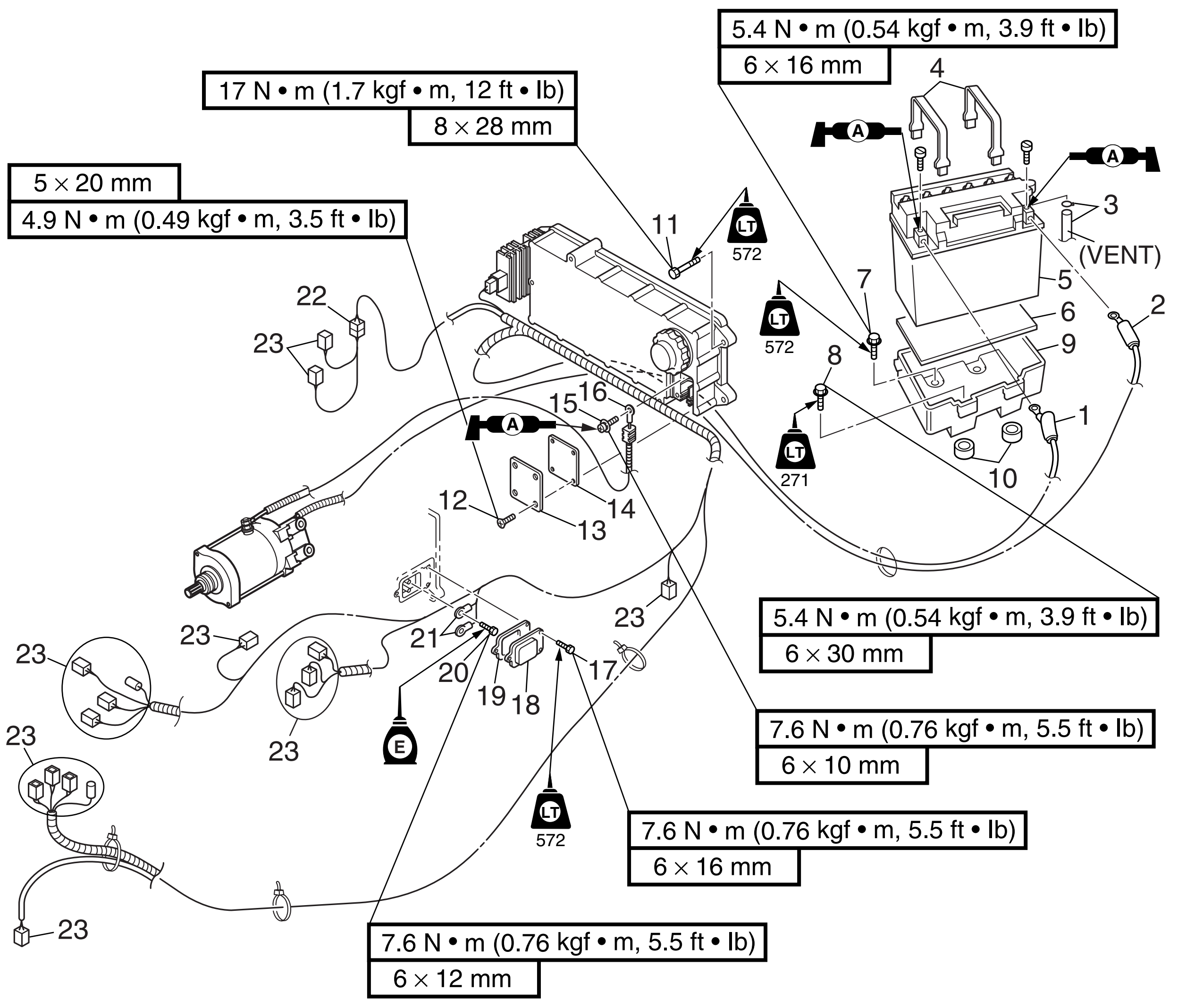
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **ELECTRICAL BOX REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Battery negative lead | 1 | |
| 2 | Battery positive lead | 1 | |
| 3 | Clip/breather hose | 1/1 | |
| 4 | Band | 2 | |
| 5 | Battery | 1 | |
| 6 | Damper | 1 | |
| 7 | Bolt | 2 | |
| 8 | Bolt | 2 | |

## EXPLODED DIAGRAM



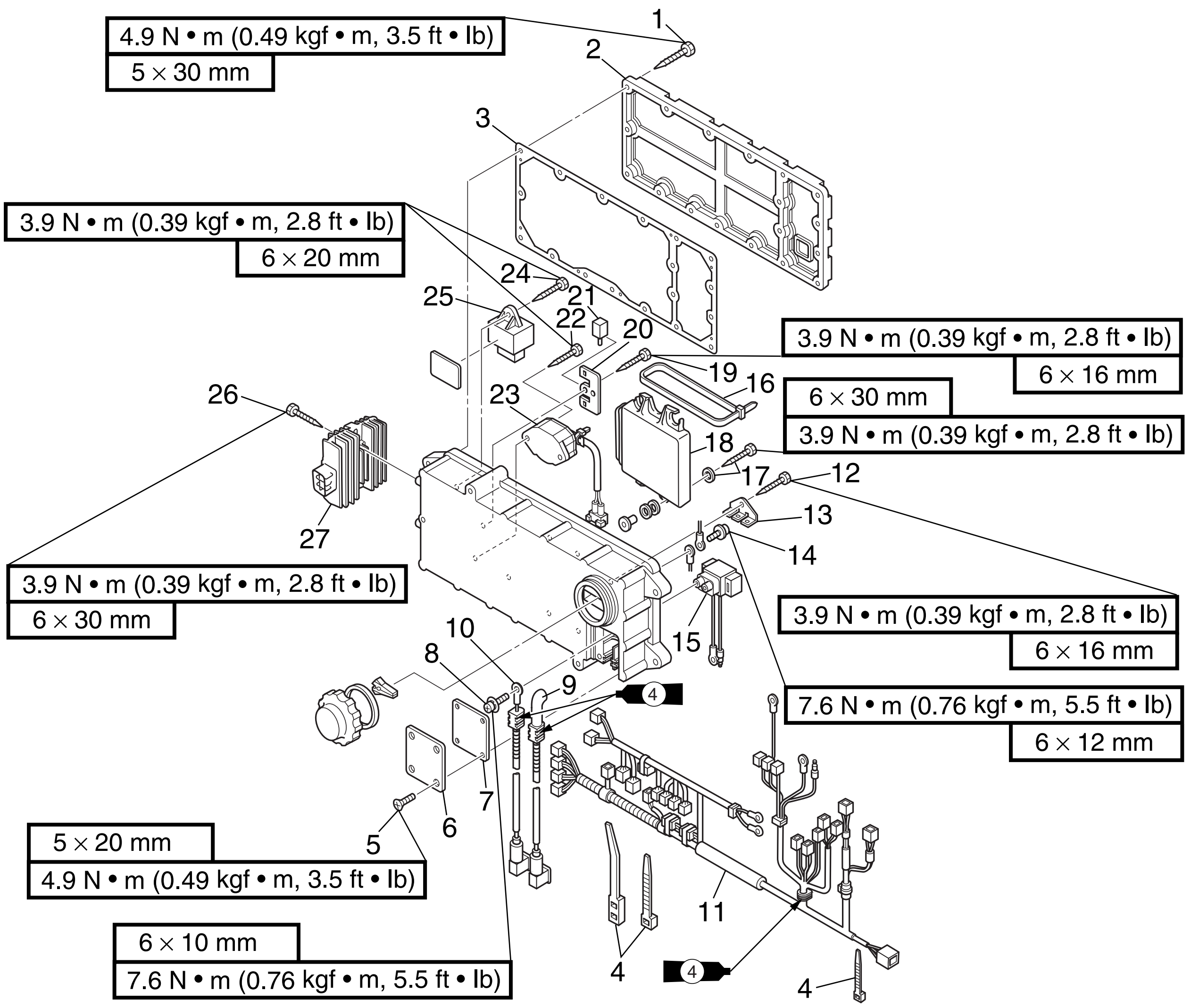

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Battery box | 1 | |
| 10 | Spacer | 2 | |
| 11 | Bolt | 4 | |
| 12 | Screw | 4 | |
| 13 | Terminal cover | 1 | |
| 14 | Gasket | 1 | Not reusable |
| 15 | Screw | 1 | |
| 16 | Starter motor lead | 1 | |
| 17 | Bolt | 3 | |
| 18 | Cover | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 19 | Gasket | 1 | **Not reusable** |
| 20 | Bolt | 2 | |
| 21 | Ground lead | 2 | |
| 22 | Holder | 1 | |
| 23 | Coupler | 15 | **NOTE:** Disconnect all couplers. |
| | | | Reverse the removal steps for installation. |

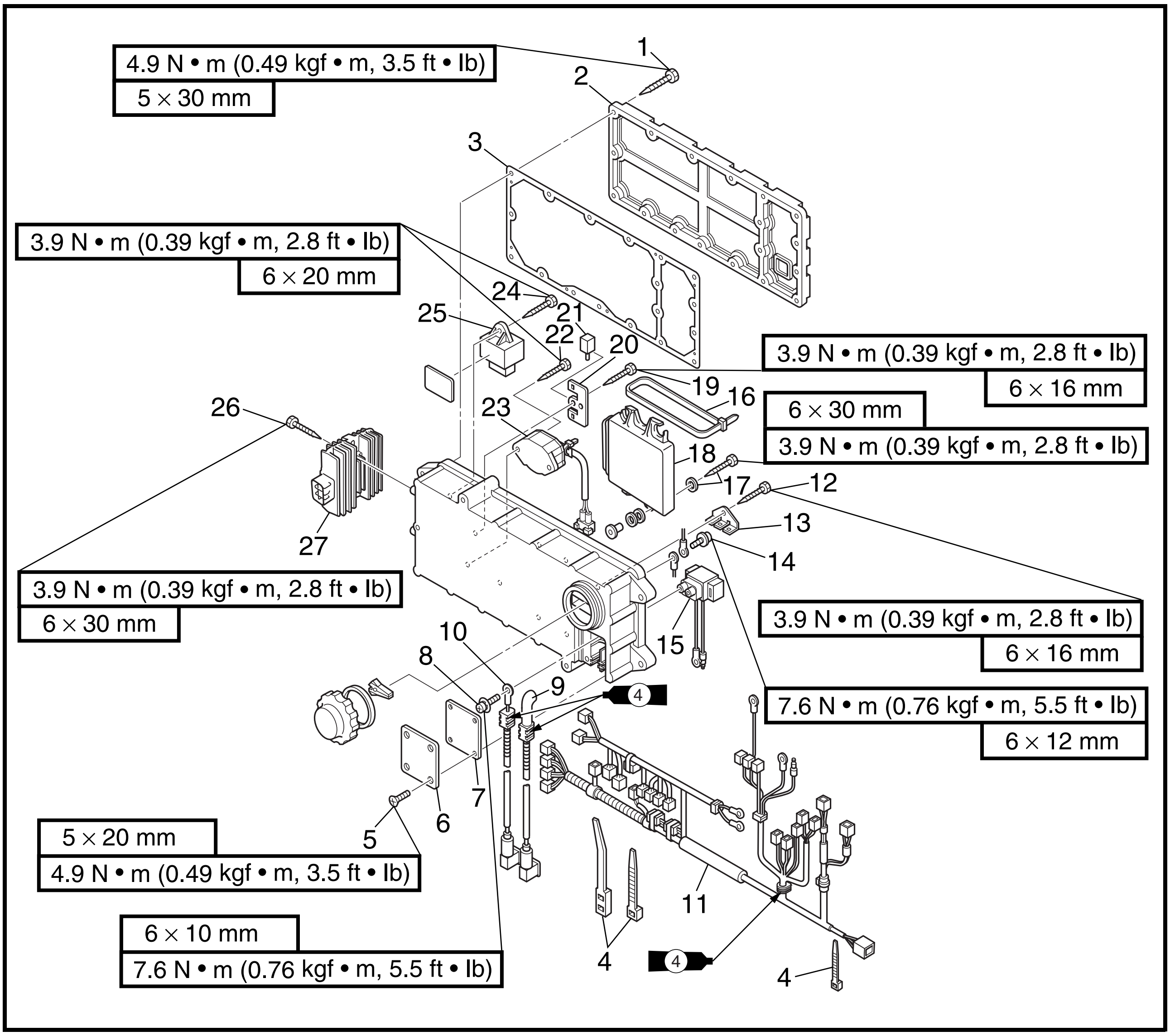
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

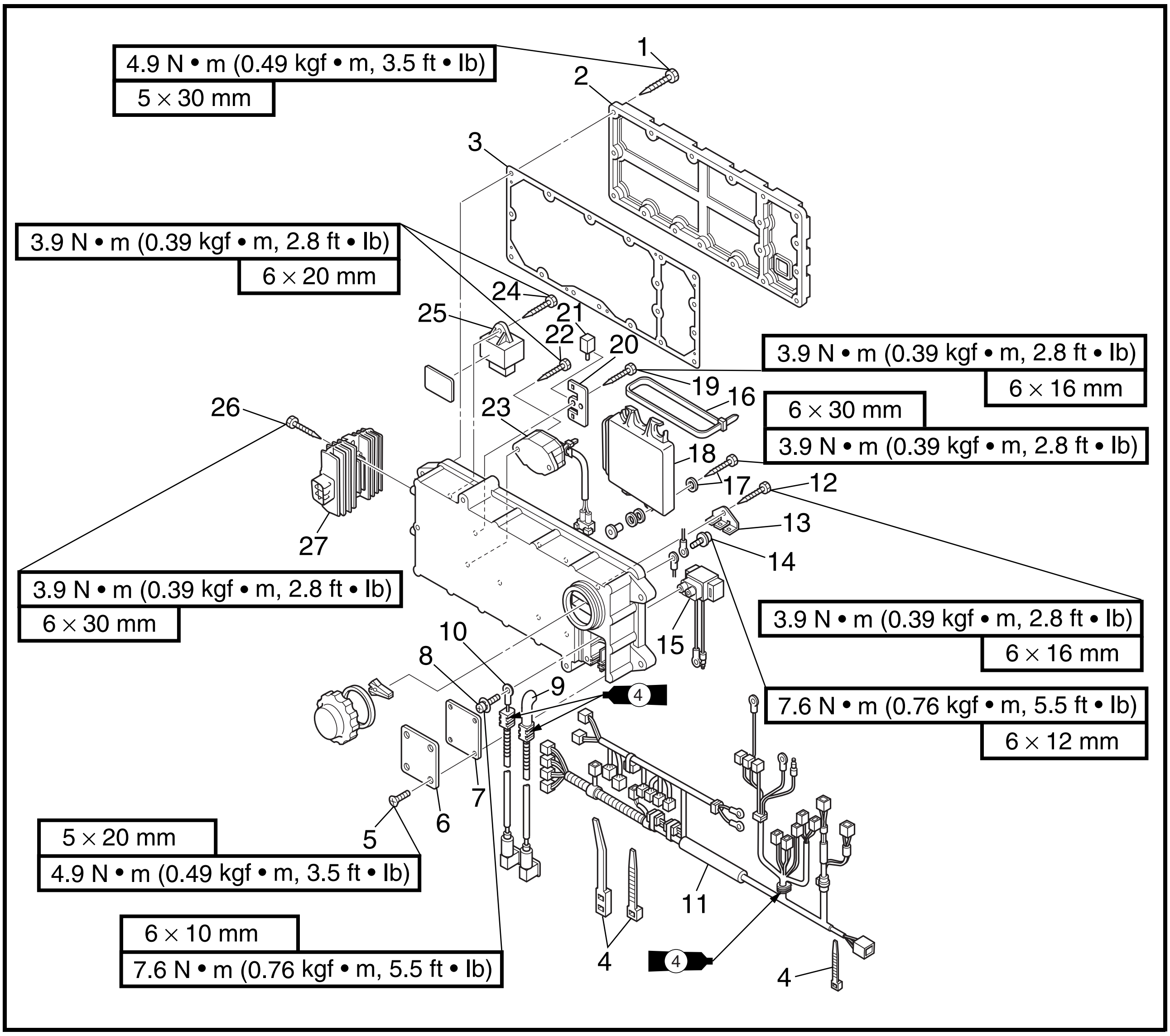
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **ELECTRICAL BOX DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Tapping screw | 18 | |
| 2 | Cover | 1 | |
| 3 | Gasket | 1 | |
| 4 | Clamp | 3 | |
| 5 | Screw | 4 | |
| 6 | Terminal cover | 1 | |
| 7 | Gasket | 1 | |
| 8 | Screw | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Battery positive lead | 1 | |
| 10 | Starter motor lead | 1 | |
| 11 | Wire harness | 1 | |
| 12 | Tapping screw | 1 | |
| 13 | Fuse holder stay | 1 | |
| 14 | Screw | 1 | |
| 15 | Starter relay | 1 | |
| 16 | Clamp | 2 | |
| 17 | Tapping screw/washer | 4/4 | |
| 18 | ECM | 1 | |

## EXPLODED DIAGRAM

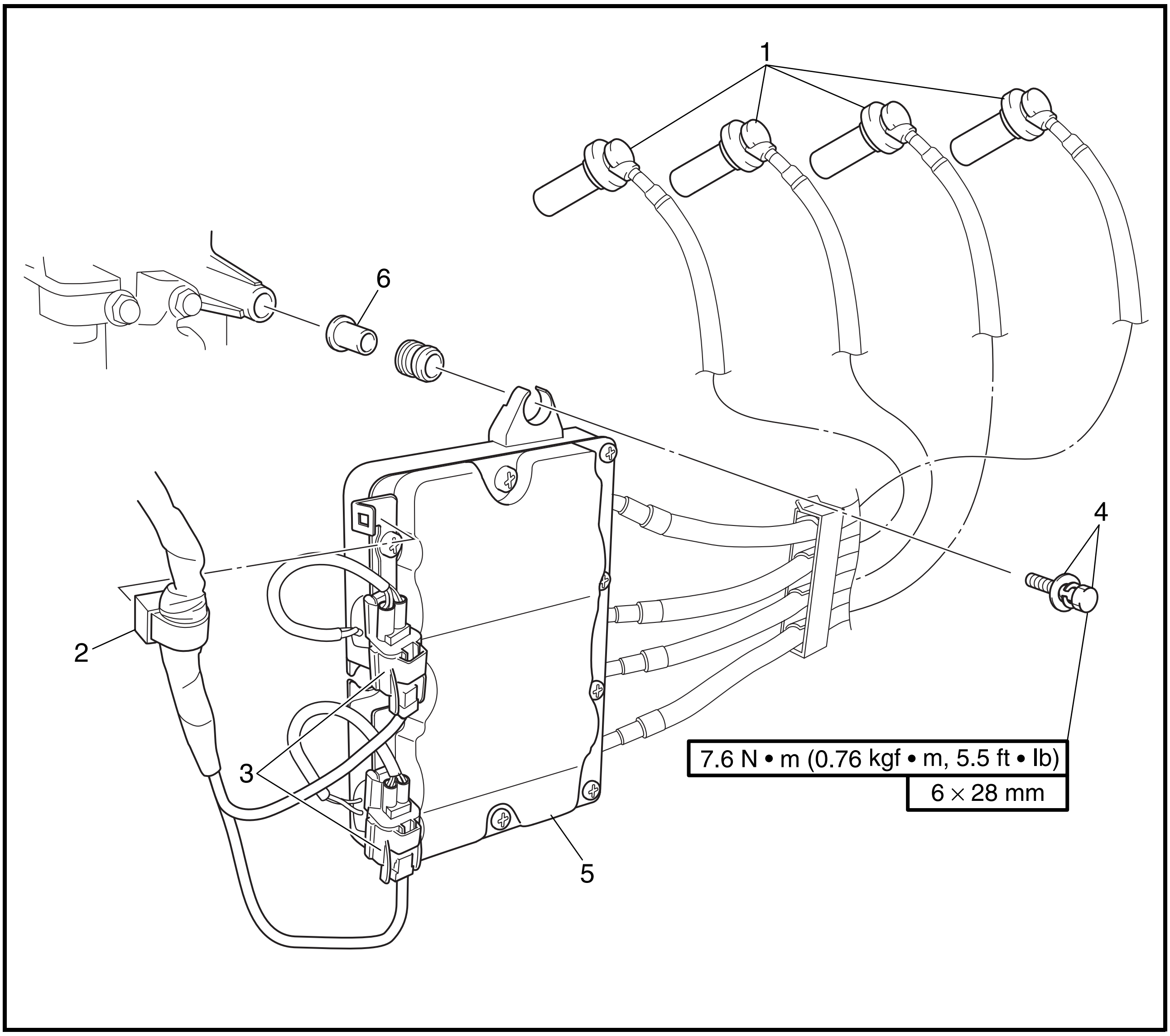



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 19 | Tapping screw | 1 | |
| 20 | Bracket | 1 | |
| 21 | Joint connector | 2 | |
| 22 | Tapping screw | 2 | |
| 23 | Slant detection switch | 1 | |
| 24 | Tapping screw | 1 | |
| 25 | Main and fuel pump relay | 1 | |
| 26 | Tapping screw | 2 | |
| 27 | Rectifier/regulator | 1 | |
| | | | Reverse the disassembly steps for assembly. |

# ELECTRICAL BOX AND IGNITION COIL BOX



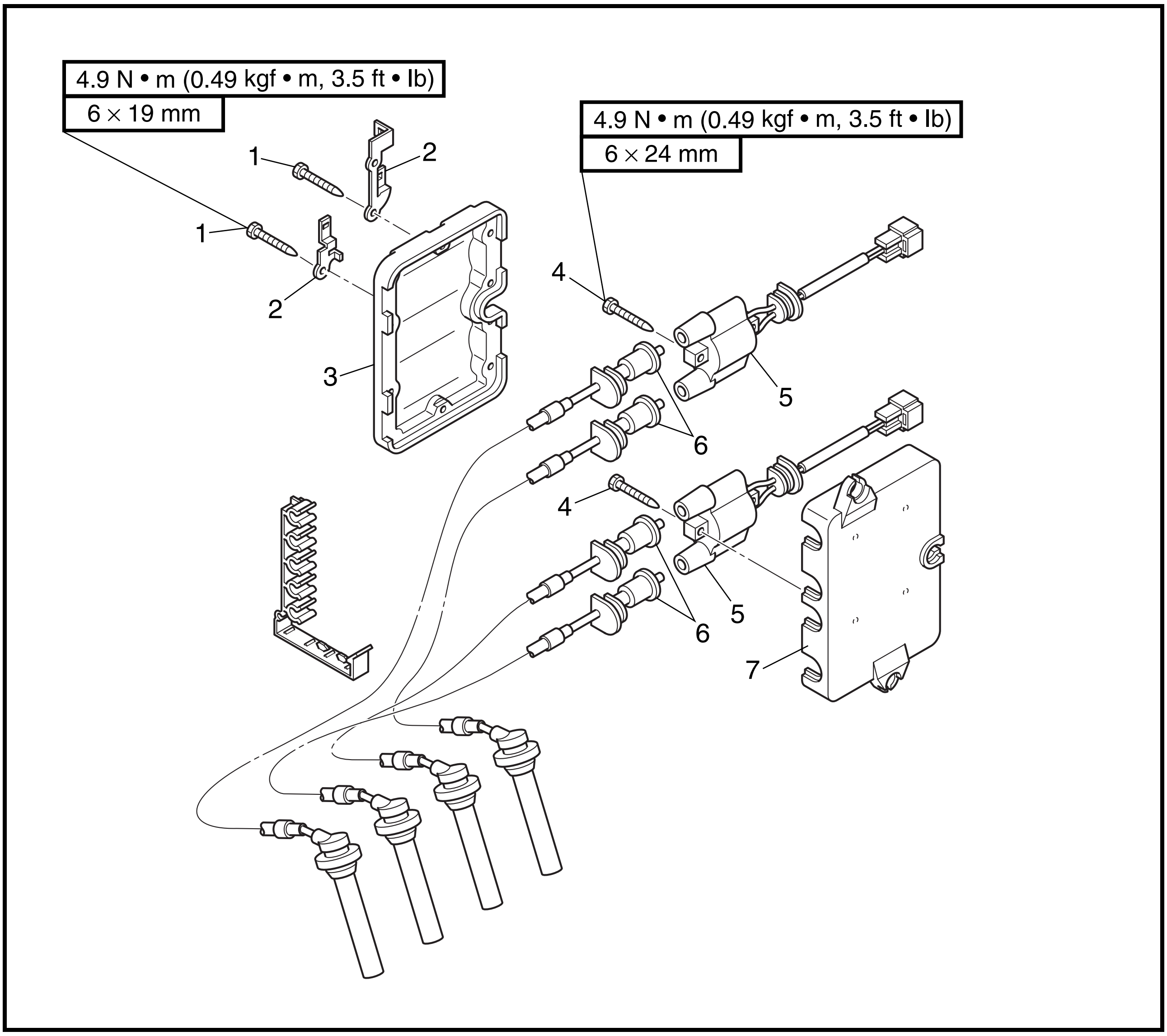
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

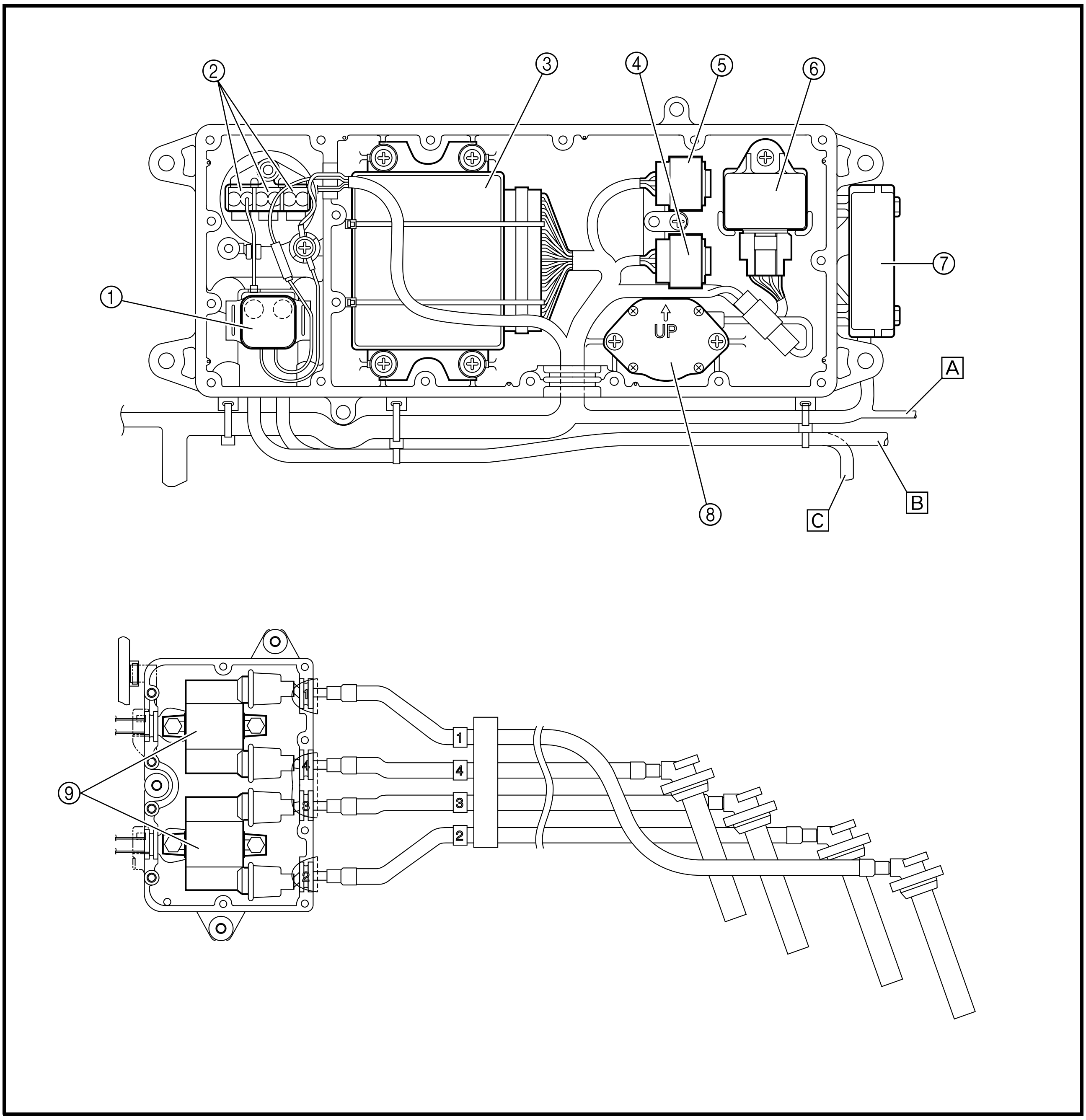
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **IGNITION COIL BOX REMOVAL** | | Follow the left "Step" for removal. |
| | Air filter | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| 1 | Spark plug cap | 4 | |
| 2 | Holder | 1 | |
| 3 | Ignition coil coupler | 2 | |
| 4 | Bolt/washer | 3/3 | |
| 5 | Ignition coil box | 1 | |
| 6 | Collar | 3 | |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **IGNITION COIL BOX DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Tapping screw | 10 | |
| 2 | Holder | 2 | |
| 3 | Ignition coil cover | 1 | |
| 4 | Tapping screw | 4 | |
| 5 | Ignition coil | 2 | |
| 6 | Hightention code | 4 | |
| 7 | Ignition coil case | 1 | |
| | | | Reverse the disassembly steps for assembly. |



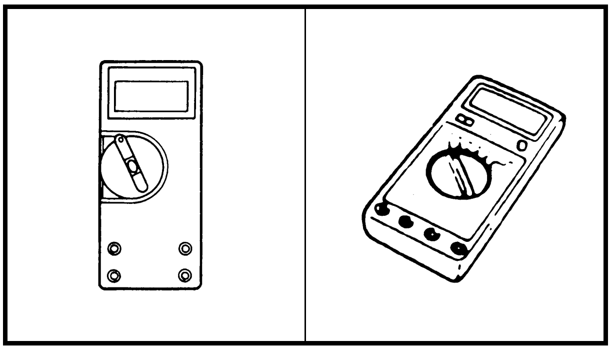

① Starter relay
② Fuse holder
③ ECM
④ Joint connector
⑤ Joint connector
⑥ Main and fuel pump relay
⑦ Rectifier/regulator
⑧ Slant detection switch
⑨ Ignition coil

A To ignition coil
B To battery positive terminal
C To starter motor

# ELECTRICAL ANALYSIS
## INSPECTION

**CAUTION:**

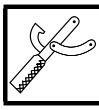
- **All measuring instruments should be handled with special care. Damaged or mishandled instruments will not measure properly.**
- **On an instrument powered by dry batteries, check the battery's voltage periodically and replace the batteries if necessary.**



**Digital tester**

**NOTE:**

Throughout this chapter the digital tester's part number has been omitted. Refer to the following part number.



| | |
|---|---|
| | **Digital circuit tester:**<br>**YU-34899-A/90890-03174** |

**NOTE:**

"○——○" indicates a continuity of electricity; i.e., a closed circuit at the respective switch position.

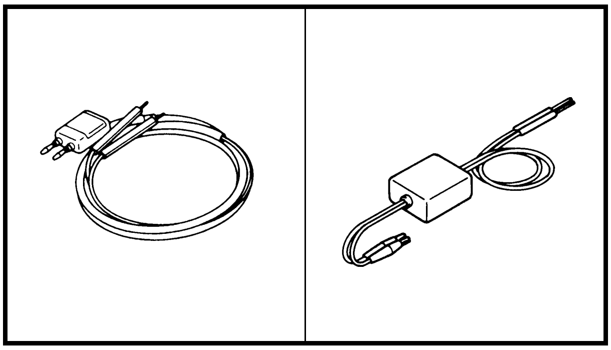
### Low resistance measurement

**NOTE:**
- When measuring a resistance of 10 Ω or less with the digital tester, the correct measurement cannot be obtained because of the tester's internal resistance.
- To obtain the correct value, subtract the internal resistance from the displayed measurement.
- The internal resistance of the tester can be obtained by connecting both of its terminals.

**Correct value =**
**Displayed measurement –**
**Internal resistance**

### Peak voltage measurement

**NOTE:**
- When checking the condition of the ignition system it is vital to know the peak voltage.
- Cranking speed is dependant on many factors (e.g., fouled or weak spark plugs, a weak battery). If one of these is defective, the peak voltage will be lower than specification.
- If the peak voltage measurement is not within specification the engine will not operate properly.
- A low peak voltage will also cause components to prematurely wear.

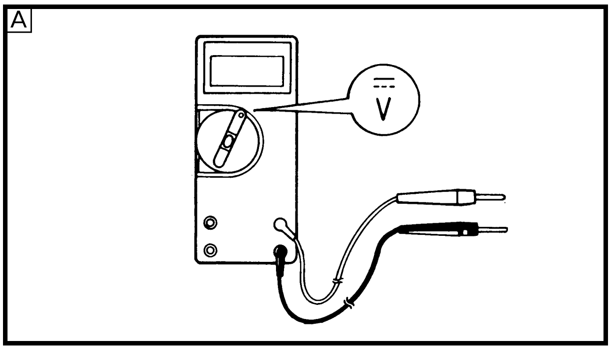


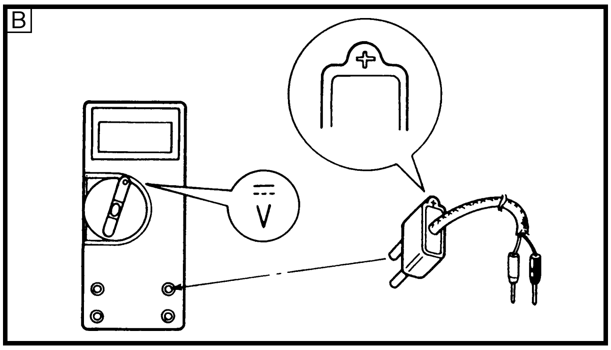
### Peak voltage adaptor

**NOTE:**
- Throughout this chapter the peak voltage adaptor's part number has been omitted. Refer to the following part number.
- The peak voltage adaptor should be used with the digital tester.

**Peak voltage adaptor:**
**YU-39991/90890-03172**

- When measuring the peak voltage, connect the peak voltage adaptor to the digital circuit tester and switch the selector to the DC voltage mode.

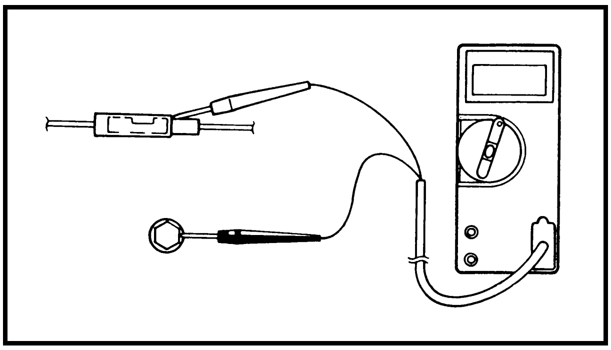


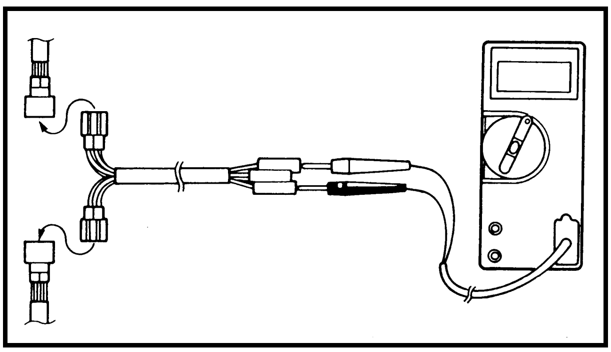




**NOTE:**
- Make sure that the adaptor leads are properly installed in the digital circuit tester.
- Make sure that the positive pin (the "+" mark facing up as shown) on the adaptor is installed into the positive terminal of the tester.
- The test harness is needed for the following tests.

A Voltage measurement
B Peak voltage measurement

### Test harness

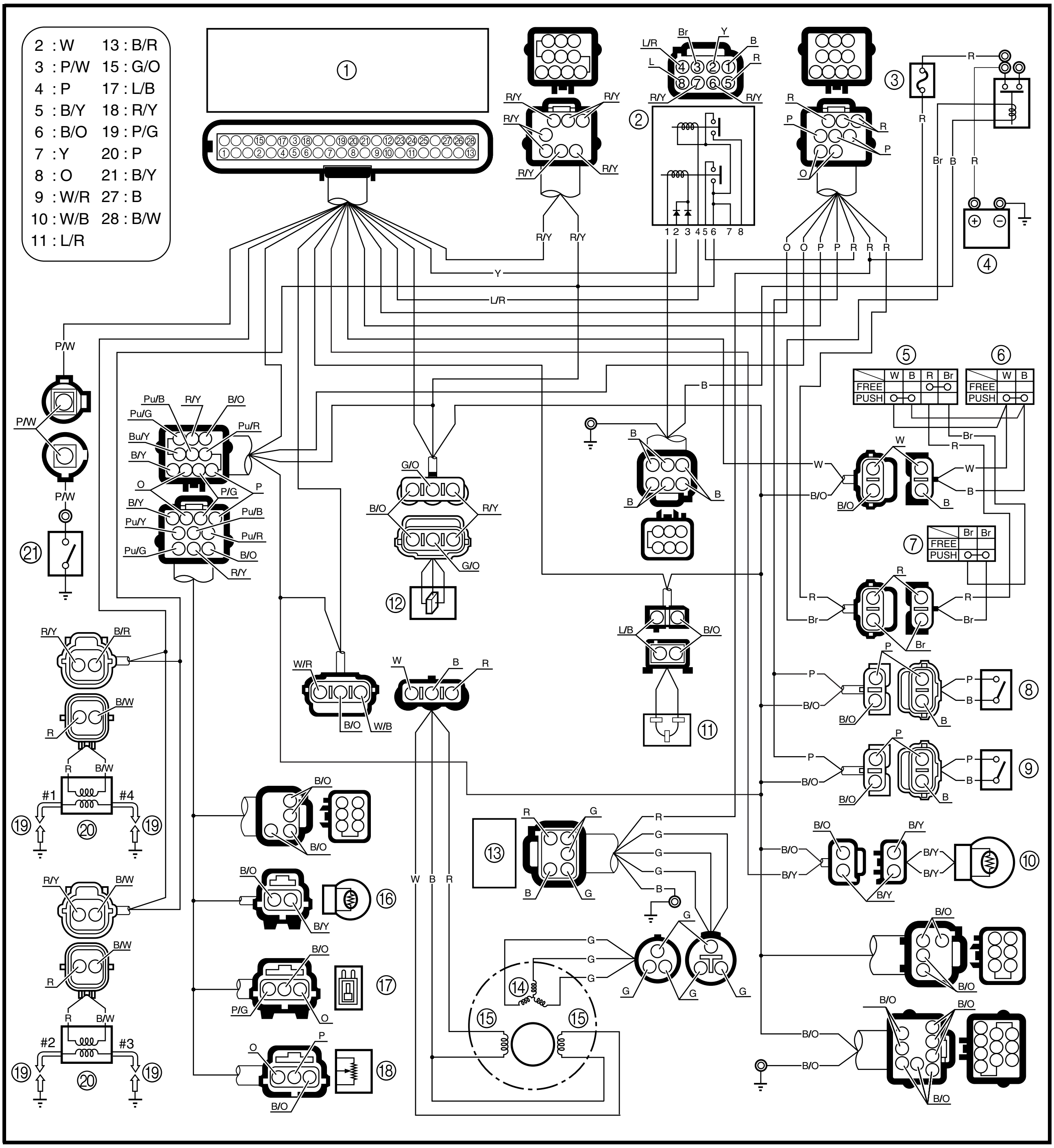




**Checking steps:**
- Disconnect the coupler connections.
- Connect the test harness between the couplers.
- Connect the tester terminals to the terminals which are being checked.
- Run the engine and observe the measurement.

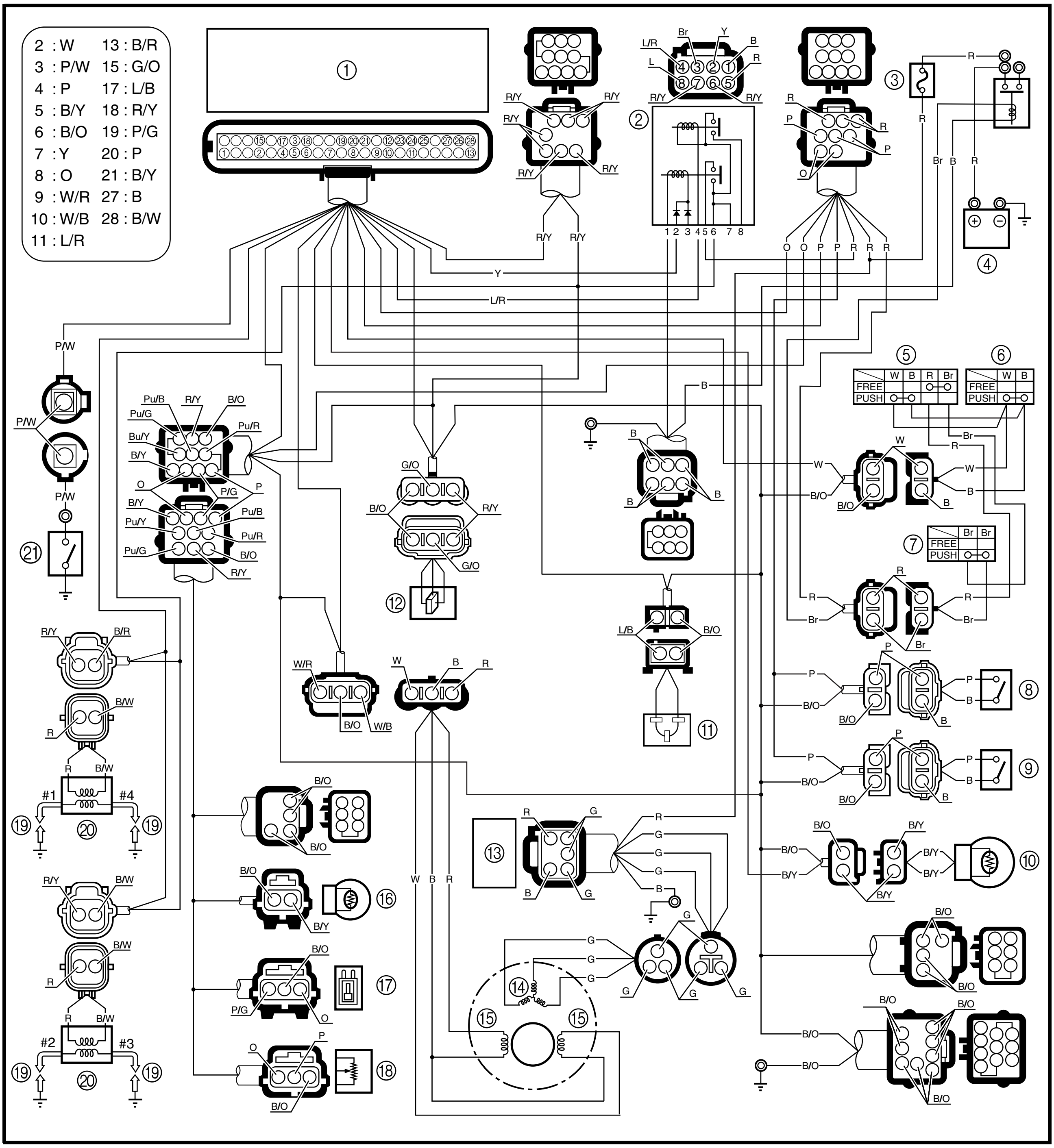
**NOTE:**
If the lighting coil and pulser coil(s) are measured unloaded, disconnect the test harness on the output side coupler.

# IGNITION SYSTEM
## WIRING DIAGRAM

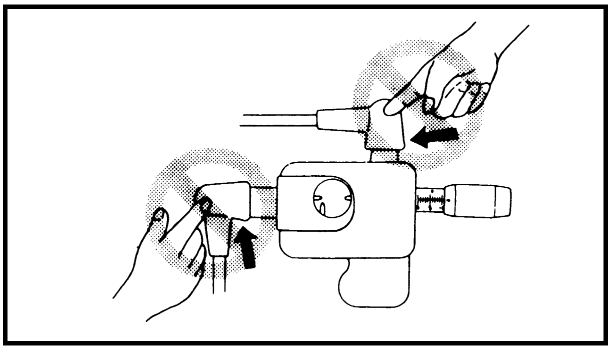



① ECM
② Main and fuel pump relay
③ Fuse (20A)
④ Battery
⑤ Engine shut-off switch
⑥ Engine stop switch
⑦ Start switch
⑧ Thermoswitch (exhaust)
⑨ Thermoswitch (engine)
⑩ Engine temperature sensor
⑪ Slant detection switch
⑫ Cam position sensor
⑬ Rectifier/regulator
⑭ Lighting coil
⑮ Pulser coil
⑯ Intake air temperature sensor
⑰ Intake air pressure sensor
⑱ Throttle position sensor
⑲ Spark plug
⑳ Ignition coil
㉑ Oil pressure switch

## WIRING DIAGRAM




| | | | | | |
|---|---|---|---|---|---|
| B | : Black | B/O | : Black/orange | R/Y | : Red/yellow |
| Br | : Brown | B/R | : Black/red | W/B | : White/black |
| G | : Green | B/W | : Black/white | W/R | : White/red |
| L | : Blue | B/Y | : Black/yellow | | |
| O | : Orange | G/O | : Green/orange | | |
| P | : Pink | L/B | : Blue/black | | |
| R | : Red | L/R | : Blue/red | | |
| W | : White | P/G | : Pink/green | | |
| Y | : Yellow | P/W | : Pink/white | | |

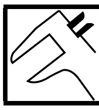


## IGNITION SPARK GAP

**⚠ WARNING**

- **When checking the spark gap, do not touch any of the connections of the spark gap tester lead wires.**
- **When performing the spark gap test, take special care not to let sparks leak out of the removed spark plug cap.**
- **When performing the spark gap check, keep flammable gas or liquids away, since this test can produce sparks.**

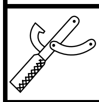
1. Check:
   - Ignition spark gap
     Below specification → Check the ECM output peak voltage.
     Check the ignition coil for resistance.



**Spark gap:**
**7–8 mm (0.28–0.31 in)**

**Checking steps:**

- Connect the spark plug cap to the spark gap tester.
- Set the spark gap length on the adjusting knob.

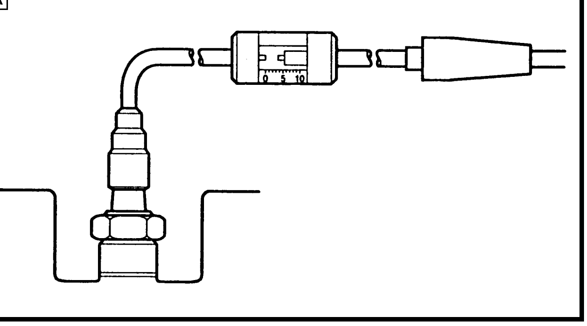


**Spark gap tester:**
**YM-34487/90890-06754**

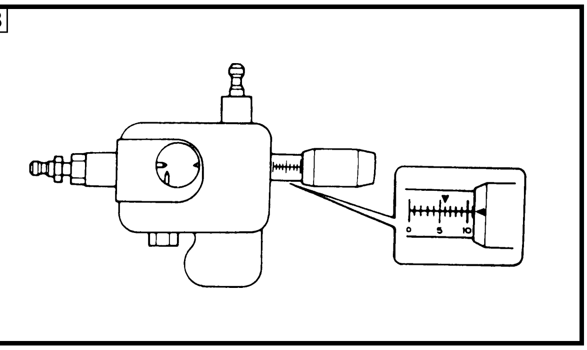
- Crank the engine and observe the ignition system spark through the discharge window.

A For USA and Canada
B For worldwide

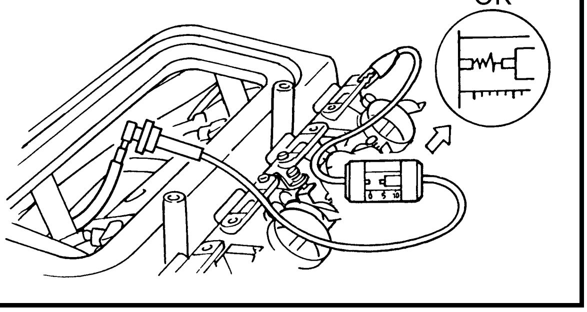
A



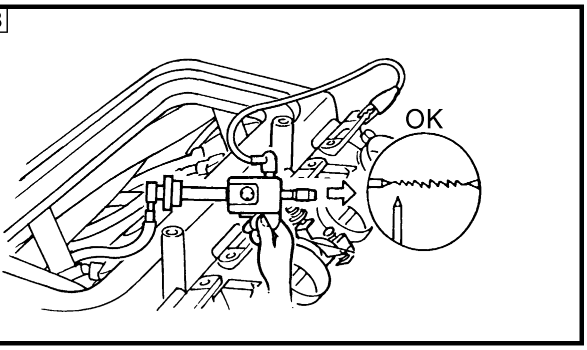
B



A




B



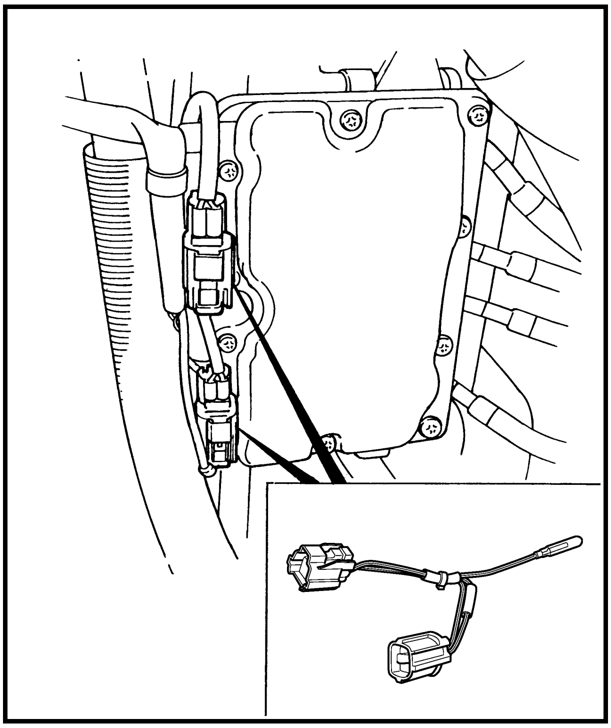
## IGNITION SYSTEM PEAK VOLTAGE

**⚠ WARNING**

**When checking the electrical components, do not touch any of the connections of the digital tester lead wires.**

**NOTE:**
- If there is no spark, or the spark is weak, continue with the ignition system test.
- If a good spark is obtained, the problem is not with the ignition system, but possibly with the spark plug(-s) or another component.

1. Measure:
   - ECM output peak voltage
     Below specification → Measure the pulser coil output peak voltage.
     Replace the ECM.

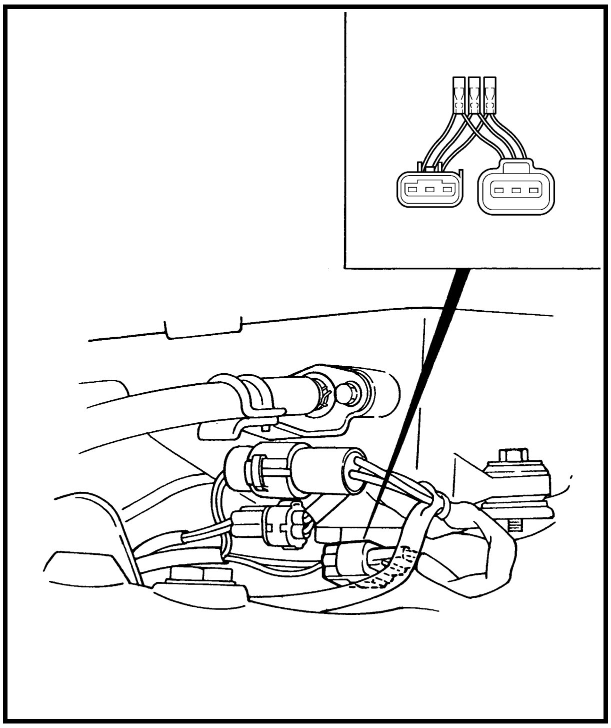


**Test harness (2 pins):**
**YB-06792/90890-06792**

**ECM output peak voltage:**
**Black/red (B/R) – Ground**
**Black/white (B/W) – Ground**

| r/min | Loaded | | |
|---|---|---|---|
| | Cranking | 2,000 | 3,500 |
| V | 7 | 258 | 258 |

**NOTE:**
B/R – Ground for cylinder #1 and #4.
B/W – Ground for cylinder #2 and #3.
To crank the engine, connect the engine shut-off cord (lanyard), and then press the start switch and engine stop switch simultaneously.



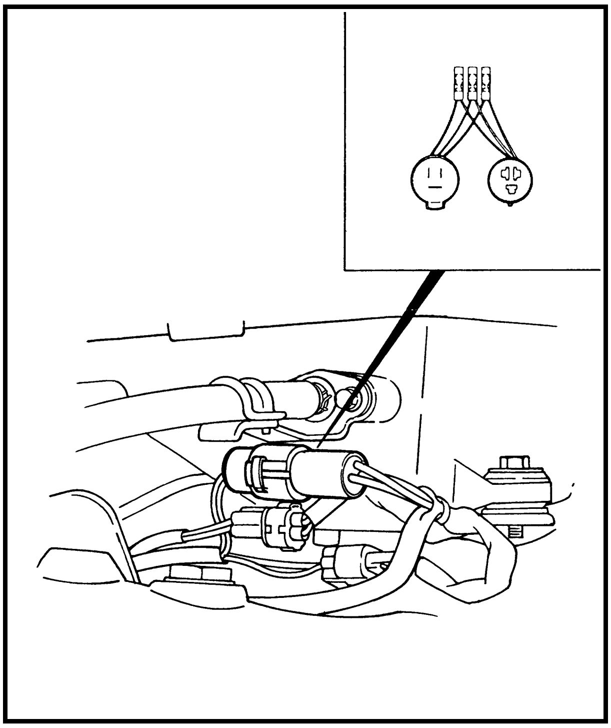
2. Measure:
   - Pulser coil output peak voltage
     Below specification → Replace the pulser coil.

| | |
|---|---|
| | **Test harness (3 pins):**<br>**YB-06791/90890-06791** |

**Pulser coil output peak voltage:**
**White (W) – Black (B)**
**Red (R) – Black (B)**

| r/min | Unloaded | Loaded | | |
|---|---|---|---|---|
| | Cranking | | 2,000 | 3,500 |
| V | 4 | 4 | 23 | 38 |

**NOTE:**
To crank the engine, connect the engine shut-off cord (lanyard), and then press the start switch and engine stop switch simultaneously.



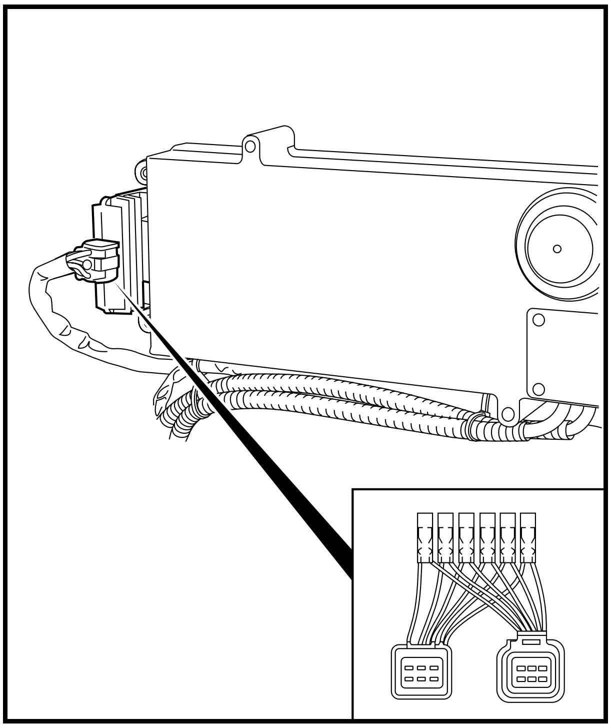
3. Measure:
   - Lighting coil output peak voltage
     Below specification → Replace the lighting coil.

| | |
|---|---|
| | **Test harness (3 pins):**<br>**YB-06770/90890-06770** |

**Lighting coil output peak voltage:**
**Green (G) – Green (G)**

| r/min | Unloaded | Loaded | | |
|---|---|---|---|---|
| | Cranking | | 2,000 | 3,500 |
| V | 9 | 8 | 11 | 12 |

**NOTE:**
To crank the engine, connect the engine shut-off cord (lanyard), and then press the start switch and engine stop switch simultaneously.



4. Measure:
   - Rectifier/regulator output voltage
     Below specification → Replace the rectifier/regulator.

**Test harness (6 pins):**
**YB-06790/90890-06790**

**Rectifier/regulator output voltage:**
**Red (R) – Black (B)**

| r/min | Loaded |
|---|---|
| | 3,500 |
| V | 14.5 |

**NOTE:**
- Before measuring the output peak voltage, make sure that the battery is fully charged.
- The output voltage gradually increases after the engine is started, therefore, maintain the specified engine speed for approximately 1 minute to measure the output voltage.

## BATTERY

Refer to “ELECTRICAL” in Chapter 3.

## FUSE

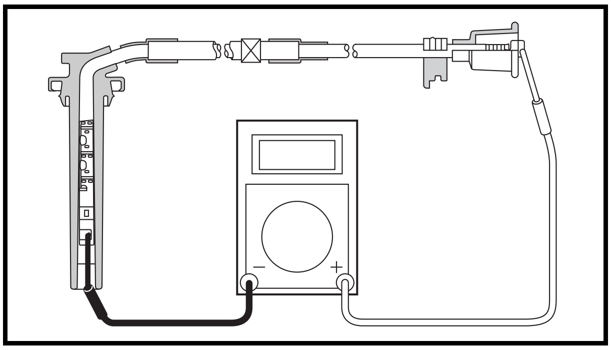
Refer to “STARTING SYSTEM”.

## SPARK PLUGS

Refer to “POWER UNIT” in Chapter 3.

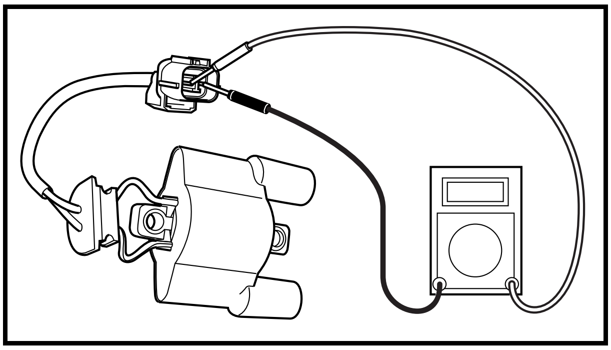
## SPARK PLUG LEAD ASSEMBLY

1. Inspect:
   - Spark plug lead assembly
     Cracks/damage → Replace.



2. Measure:
   - Spark plug lead resistance
     Out of specification → Replace.

**Spark plug lead resistance:**
**#1: 6.4–14.9 kΩ**
**#2: 5.9–13.8 kΩ**
**#3: 4.7–11.1 kΩ**
**#4: 4.4–10.5 kΩ**



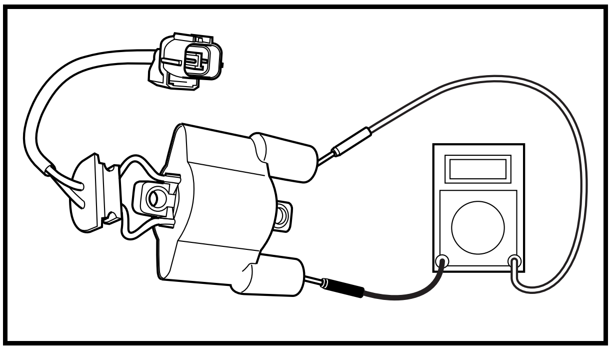
## IGNITION COIL

1. Measure:
   - Primary coil resistance
     Out of specification → Replace.

| **Primary coil resistance:** |
|---|
| **Black/white (B/W) – Red (R)** |
| **1.53–2.07 Ω at 20 °C (68 °F)** |

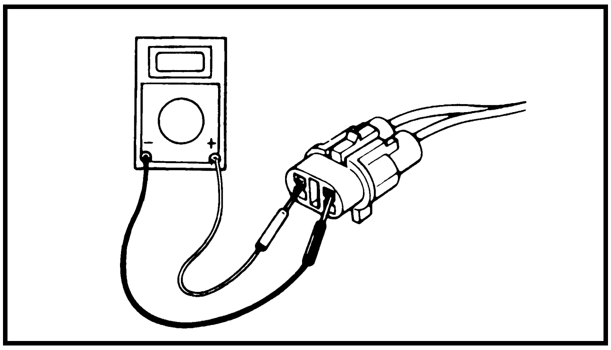
**NOTE:**

When measuring a resistance of 10 Ω or less with the digital tester, the correct measurement cannot be obtained because of the tester's internal resistance.
Refer to "Low resistance measurement".



2. Measure:
   - Secondary coil resistance
     Out of specification → Replace.

| **Secondary coil resistance:** |
|---|
| **12.5–16.9 kΩ at 20 °C (68 °F)** |

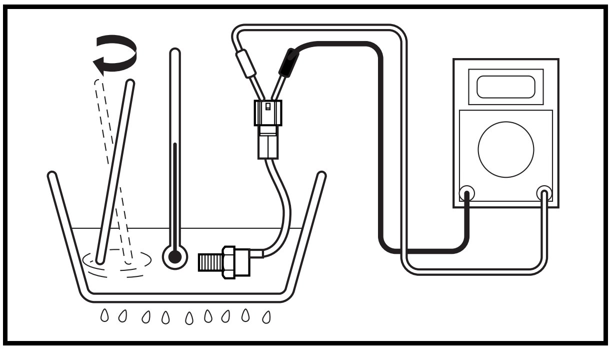


## ENGINE STOP SWITCH

1. Check:
   - Engine stop switch continuity
     Out of specification → Replace.

**Engine stop switch continuity (black coupler)**

| Clip | Position | Lead color | |
|---|---|---|---|
| | | White | Black |
| Installed | Free | | |
| | Push | ○ | ○ |
| Removed | Free | ○ | ○ |
| | Push | ○ | ○ |

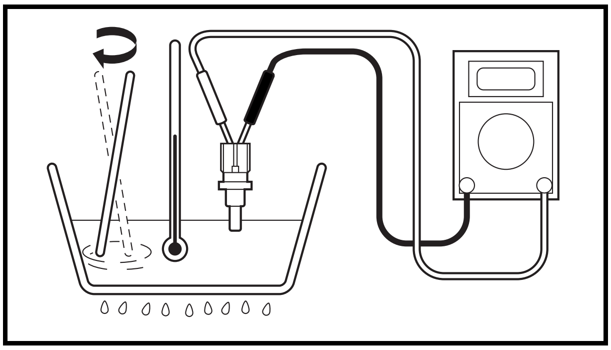


## ENGINE TEMPERATURE SENSOR

1. Measure:
   - Engine temperature sensor resistance (at the specified temperature)
     Out of specification → Replace.

**Engine temperature sensor resistance:**
**20 °C (68 °F): 54.2–69.0 kΩ**
**100 °C (212 °F): 3.12–3.48 kΩ**

**Measurement steps:**
- Suspend the engine temperature sensor in a container filled with water.
- Slowly heat the water.
- Measure the resistance when the specified temperature is reached.

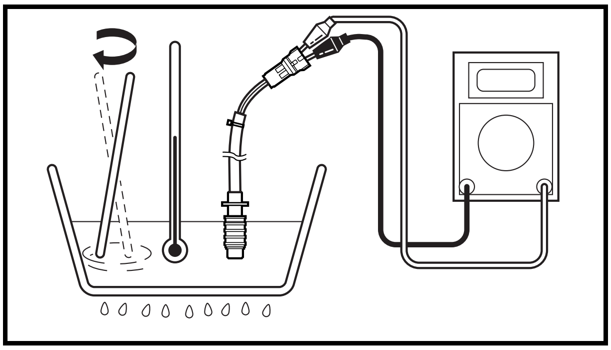


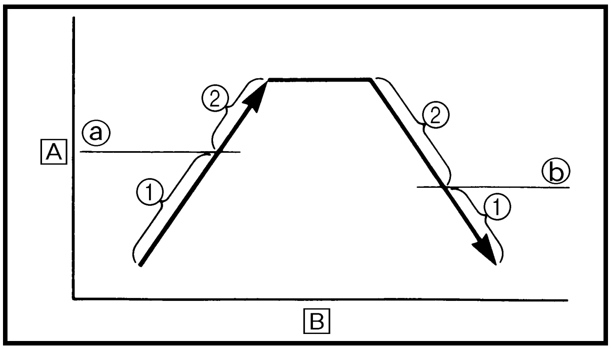
## INTAKE AIR TEMPERATURE SENSOR

1. Measure:
   - Intake air temperature sensor resistance (at the specified temperature)
     Out of specification → Replace.

**Intake air temperature sensor resistance:**
**0 °C (32 °F): 5.4–6.6 kΩ**
**80 °C (176 °F): 0.29–0.39 kΩ**

**Measurement steps:**
- Suspend the intake air temperature sensor in a container filled with water.
- Slowly heat the water.
- Measure the resistance when the specified temperature is reached.





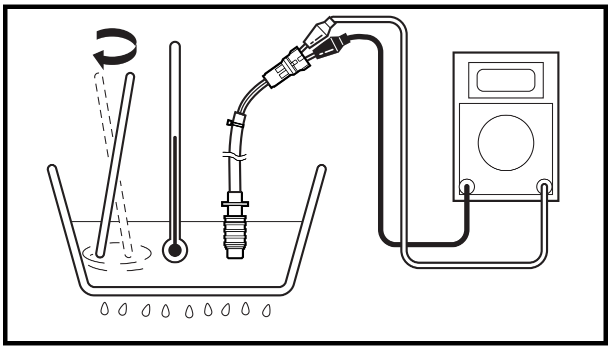

## THERMOSWITCH (ENGINE)

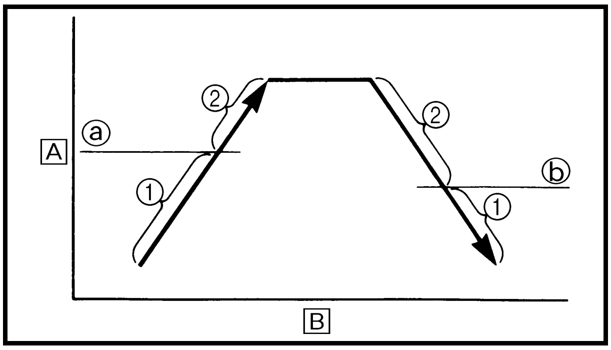
1. Check:
   - Thermoswitch (engine) continuity (at the specified temperature)
     Out of specification → Replace.

| |
|---|
| **Thermoswitch (engine) continuity temperature:**<br>**ⓐ 84–90 °C (183–194 °F)**<br>**ⓑ 70–84 °C (158–183 °F)** |

① No continuity
② Continuity
[A] Temperature
[B] Time

**Checking steps:**
- Suspend the thermoswitch (engine) in a container filled with water.
- Place a thermometer in the water.
- Slowly heat the water.
- Measure the continuity when the specified temperature is reached.





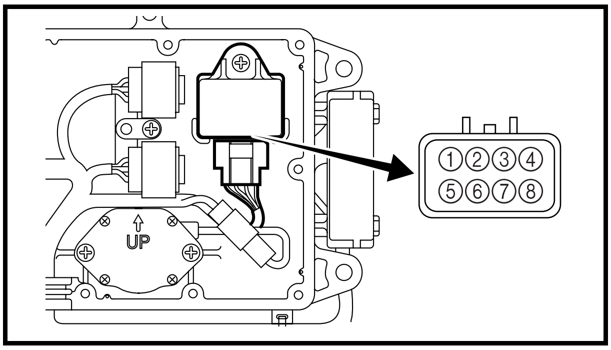

## THERMOSWITCH (EXHAUST)

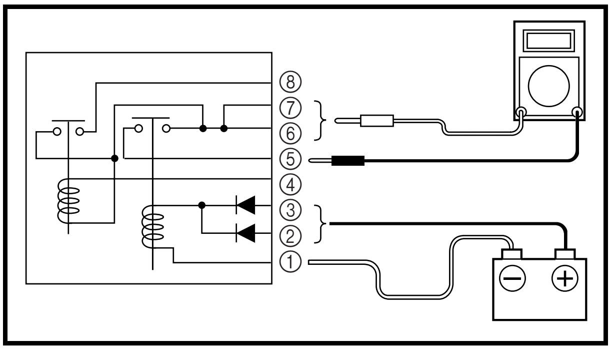
1. Check:
   - Thermoswitch (exhaust) continuity (at the specified temperature)
     Out of specification → Replace.

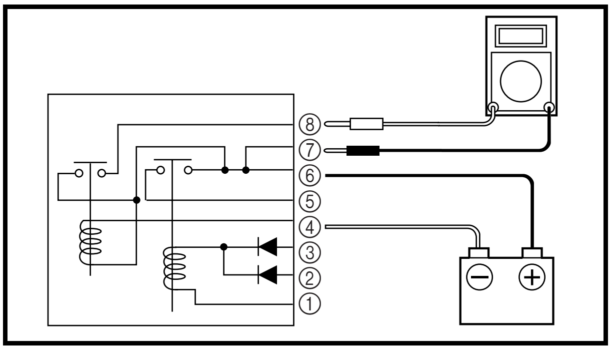
| |
|---|
| **Thermoswitch (exhaust) continuity temperature:**<br>**ⓐ 94–100 °C (201–212 °F)**<br>**ⓑ 80–94 °C (176–201 °F)** |

① No continuity
② Continuity
[A] Temperature
[B] Time

**Checking steps:**
- Suspend the thermoswitch (exhaust) in a container filled with water.
- Place a thermometer in the water.
- Slowly heat the water.
- Measure the continuity when the specified temperature is reached.



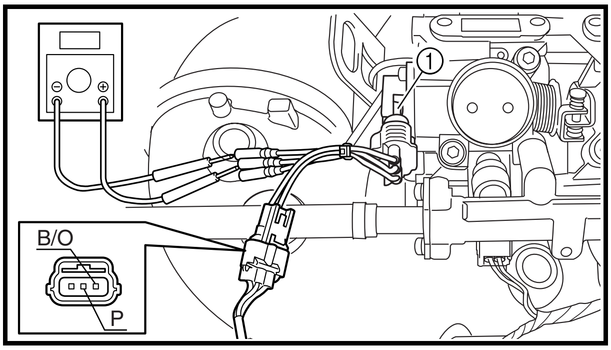



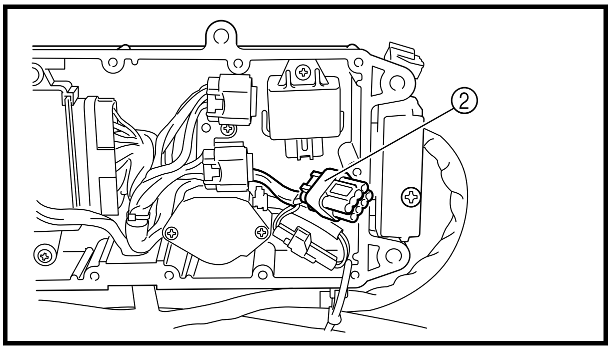

## MAIN AND FUEL PUMP RELAY

1. Check:
   - Main and fuel pump relay continuity
     Faulty → Replace.

**Checking steps:**

- Connect the tester leads between the main and fuel pump relay terminals ⑤, ⑥ and ⑦.
- Connect the terminals ② or ③ to the positive battery terminal.
- Connect the terminal ① to the negative battery terminal.
- Check that there is continuity between the main and fuel pump relay terminals.
- Check that there is no continuity between the main and fuel pump relay terminals after disconnecting terminals ②, ③ or ①.
- Connect the tester leads between the main and fuel pump relay terminals ⑦ and ⑧.
- Connect the terminals ④ to the negative battery terminal.
- Connect the terminal ⑥ to the positive battery terminal.
- Check that there is continuity between the main and fuel pump relay terminals.
- Check that there is no continuity between the main and fuel pump relay terminals after disconnecting terminals ④ or ⑥.



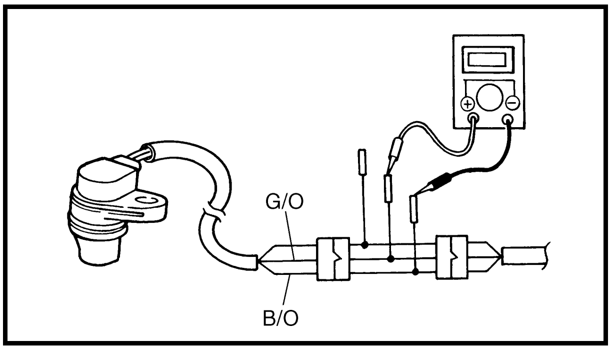

## THROTTLE POSITION SENSOR

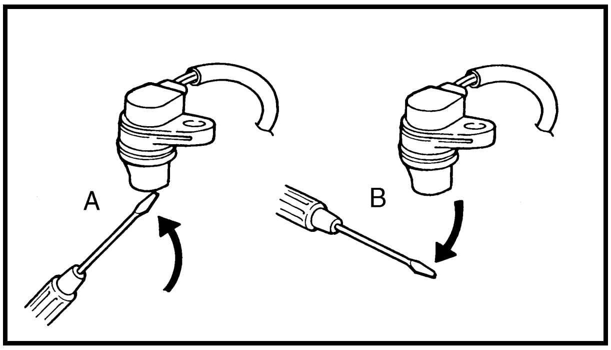
1. Measure:
   - Throttle position sensor output voltage
     Out of specification → Adjust the throttle bodies synchronization.
     Refer to “FUEL INJECTION SYSTEM” in Chapter 4.

**Test harness (3 pins):**
**YB-06793/90890-06793**
**Test connector:**
**YW-06862/90890-06862**

**Throttle position sensor output voltage:**
**Pink (P) – Black/Orange (B/O)**
**0.760 ± 0.016 V**

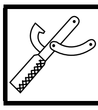
**Measurement steps:**
- Connect the test harness (3 pins) to the throttle position sensor ①.
- To start the ECM normally, use the Yamaha Diagnostic System. Use the test connector ② to start the ECU normally only if the Yamaha Diagnostic System is not available.
- Measure the throttle position sensor output voltage.



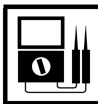




## CAM POSITION SENSOR

1. Measure:
   - Cam position sensor output voltage
     Out of specification → Replace.



**Test harness (3 pins):**
**YB-06777/90890-06777**

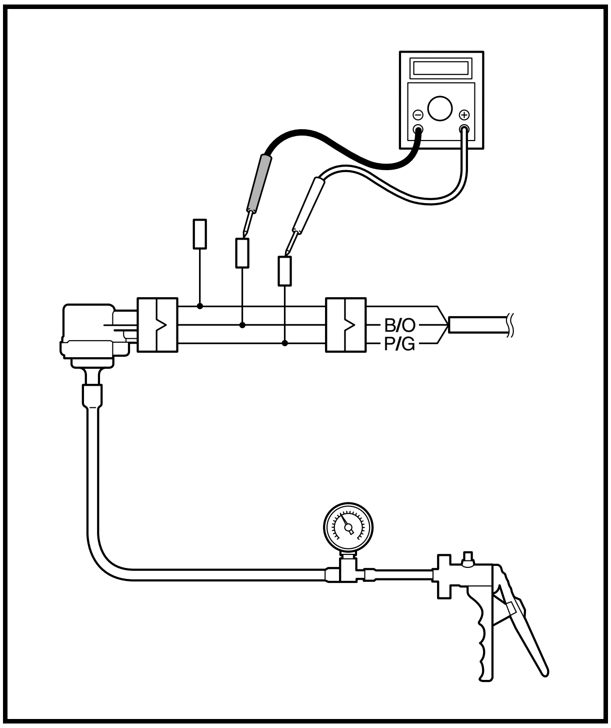


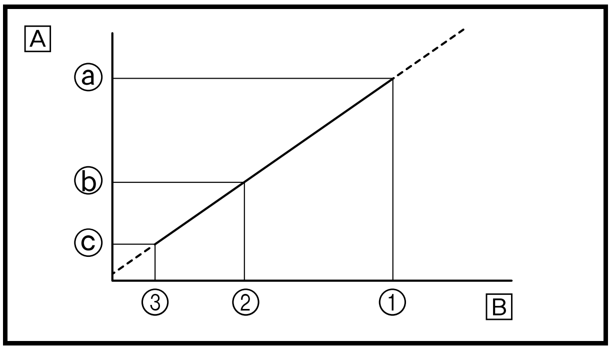
**Cam position sensor output voltage:**
**Green/orange (G/O) – Black/orange (B/O)**

| Position | Voltage (V) |
|---|---|
| A | More than 0.8 |
| B | Less than 4.8 |

**Measurement steps:**
- Remove the cam position sensor.
- Connect the test harness (3 pins) to the cam position sensor.
- Operate the Yamaha Diagnostic System.
- Measure the output voltage when holding a screwdriver to the sensor and when holding it away from the sensor.

**NOTE:**
When operating the Yamaha Diagnostic System, electric power is supplied to the cam position sensor.




## INTAKE AIR PRESSURE SENSOR

1. Measure:
   - Intake air pressure sensor output voltage
     Out of specification → Replace.

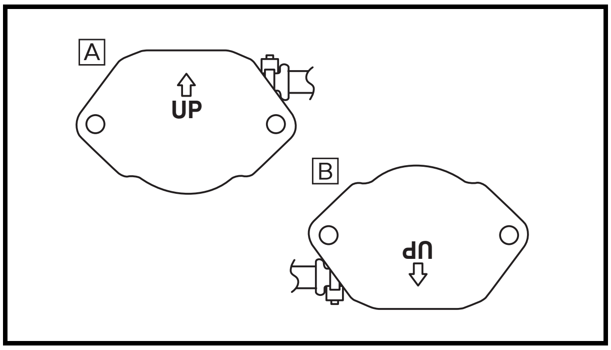
**Test harness (3 pins):**
**YB-06769/90890-06769**
**Vacuum/pressure pump gauge set:**
**YB-35956-A/90890-06756**

**Intake air pressure sensor output voltage:**
**Pink/green (P/G) – Black/orange (B/O)**
**① 101.3 kPa (1.01 kgf/cm², 14.4 psi):**
**ⓐ 4.00 V**
**② 50 kPa (0.5 kgf/cm², 7.1 psi):**
**ⓑ 1.97 V**
**③ 20 kPa (0.2 kgf/cm², 2.8 psi):**
**ⓒ 0.79 V**

A: Output voltage B: Vacuum pressure

**Measurement steps:**
- Remove the intake air pressure sensor.
- Connect the test harness (3 pins) to the intake air pressure sensor.
- Operate the Yamaha Diagnostic System.
- Apply vacuum pressure to the intake air pressure sensor and measure the output voltage.

**NOTE:**
When operating the Yamaha Diagnostic System, electric power is supplied to the intake air pressure sensor.

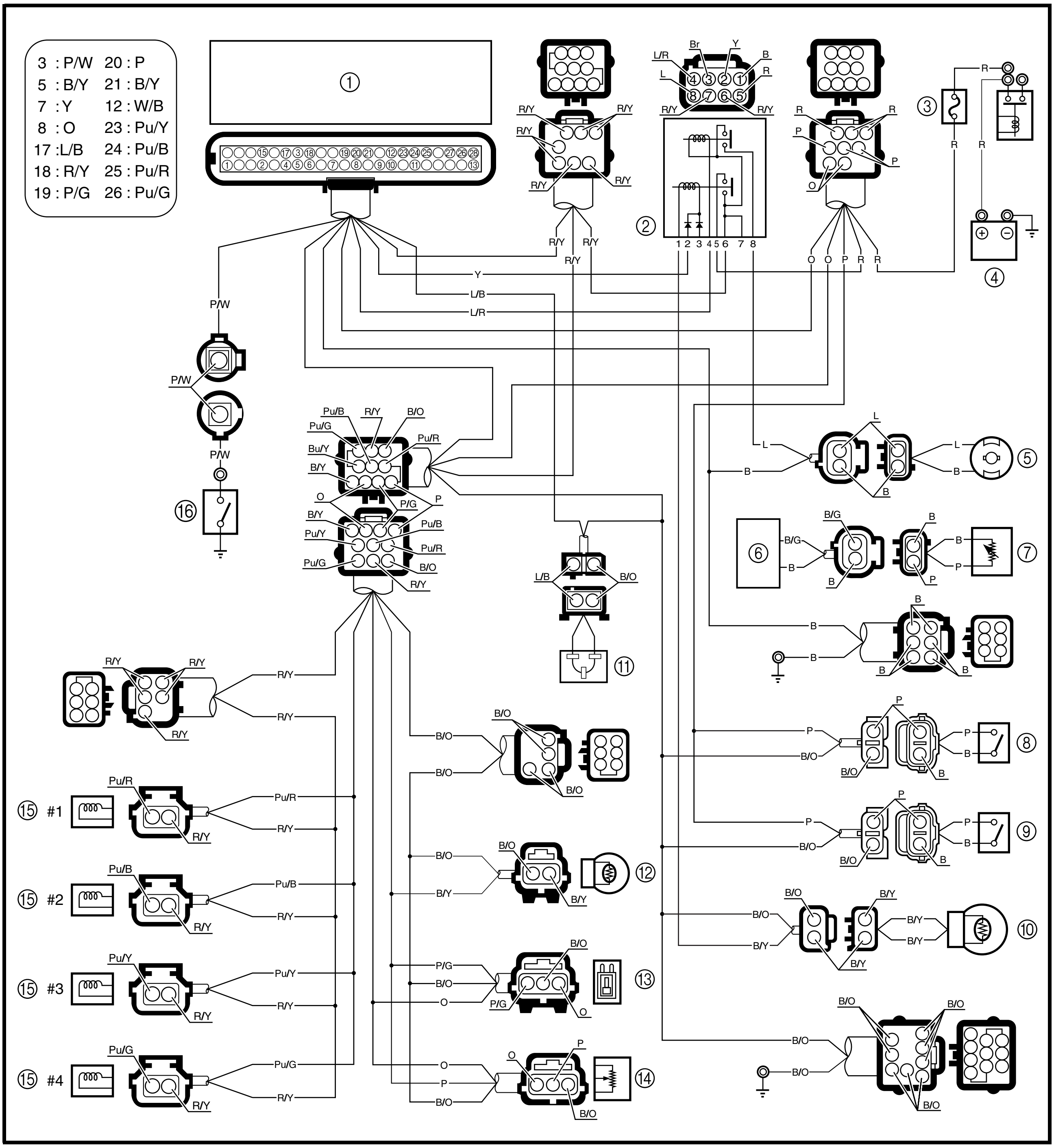



## SLANT DETECTION SWITCH

1. Check:
   - Slant detection switch continuity
     Out of specification → Replace.

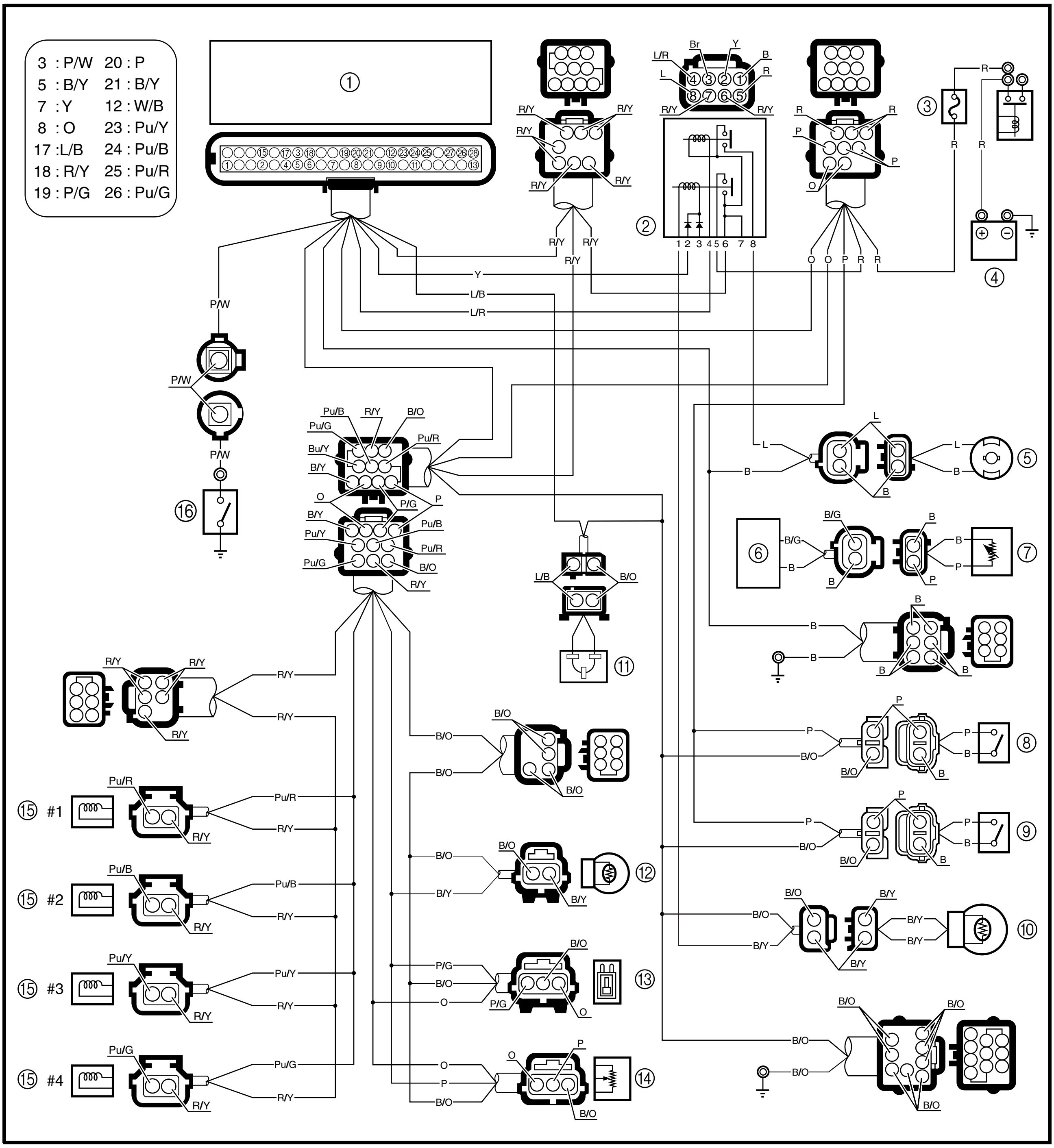
| Position | Lead color | |
|---|---|---|
| | Blue/black (L/B) | Black/ orange (B/O) |
| Normal operation A | | |
| Overturned B | ○—— | ——○ |

# FUEL CONTROL SYSTEM
## WIRING DIAGRAM




① ECM
② Main and fuel pump relay
③ Fuse (20A)
④ Battery
⑤ Fuel pump
⑥ Multifunction meter
⑦ Fuel sender
⑧ Thermoswitch (exhaust)
⑨ Thermoswitch (engine)
⑩ Engine temperature sensor
⑪ Slant detection switch
⑫ Intake air temperature sensor
⑬ Intake air pressure sensor
⑭ Throttle position sensor
⑮ Fuel injector
⑯ Oil pressure switch

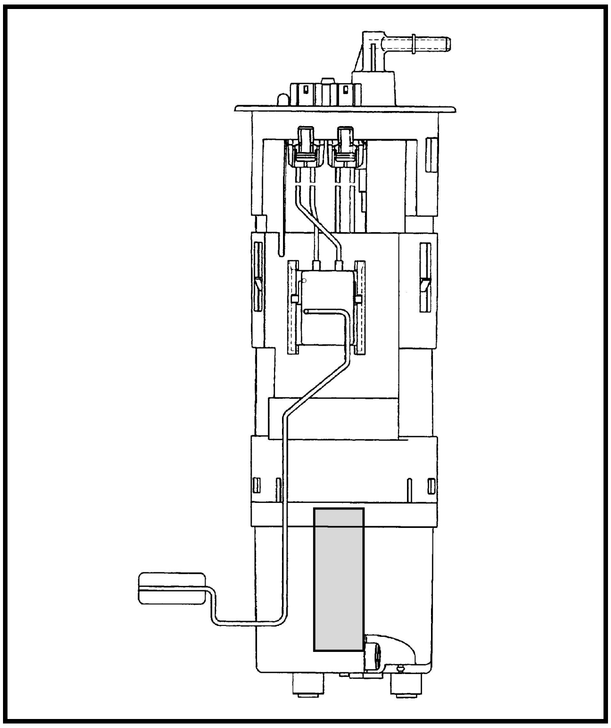
## WIRING DIAGRAM




B : Black
Br : Brown
G : Green
L : Blue
O : Orange
P : Pink
R : Red
W : White
Y : Yellow

B/O : Black/orange
B/Y : Black/yellow
G/O : Green/orange
L/B : Blue/black
L/R : Blue/red
P/G : Pink/green
P/W : Pink/white
Pu/B : Purple/black
Pu/G : Purple/green

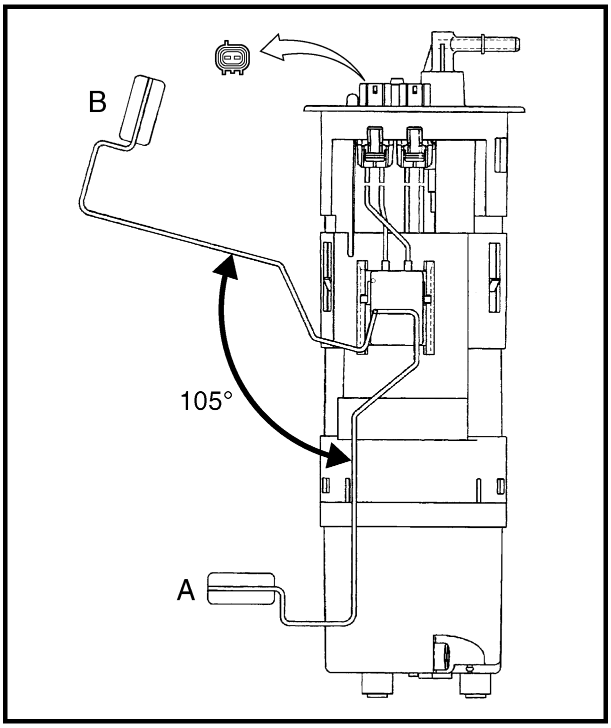
Pu/R : Purple/red
Pu/Y : Purple/yellow
R/Y : Red/yellow
W/B : White/black
W/R : White/red



## FUEL PUMP

1. Check:
   - Fuel pump operating sound
     Fuel pump does not sound → Measure the fuel pressure.
     Refer to "FUEL INJECTION SYSTEM" in Chapter 4.

**NOTE:**
After the engine is stopped, the fuel pump will operate for 10 seconds.




## FUEL SENDER

1. Measure:
   - Fuel sender resistance
     Out of specification → Replace.

| Float position | Resistance (Ω) |
|---|---|
| A | 91–93 |
| B | 6–8 |

## FUEL INJECTOR

Refer to “FUEL INJECTION SYSTEM” in Chapter 4.

## MAIN AND FUEL PUMP RELAY

Refer to “IGNITION SYSTEM”.

## OIL PRESSURE SWITCH

Refer to “IGNITION SYSTEM”.

## THERMOSWITCH (ENGINE)

Refer to “IGNITION SYSTEM”.

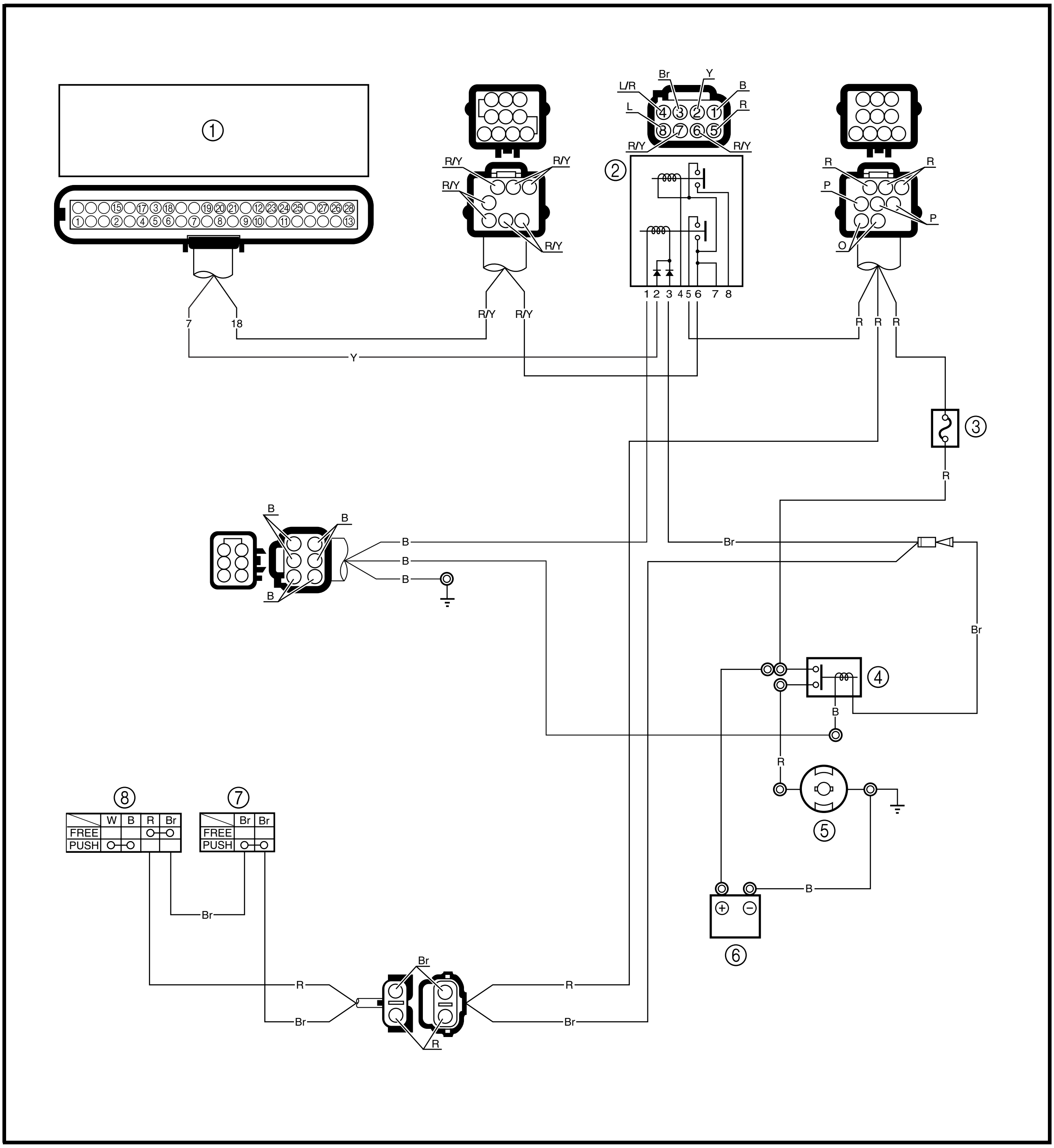
## THERMOSWITCH (EXHAUST)

Refer to “IGNITION SYSTEM”.

## SLANT DETECTION SWITCH

Refer to “IGNITION SYSTEM”.

# STARTING SYSTEM
## WIRING DIAGRAM



① ECM
② Main and fuel pump relay
③ Fuse (20A)
④ Starter relay
⑤ Starter motor
⑥ Battery
⑦ Start switch
⑧ Engine shut-off switch

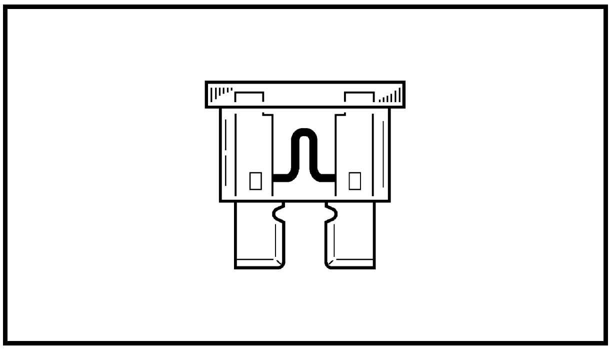
B : Black
Br : Brown
R : Red
Y : Yellow
R/Y : Red/yellow

### BATTERY

Refer to “ELECTRICAL” in Chapter 3.

### WIRING CONNECTIONS

1. Check:
   - Wiring connections
     Poor connections → Properly connect.

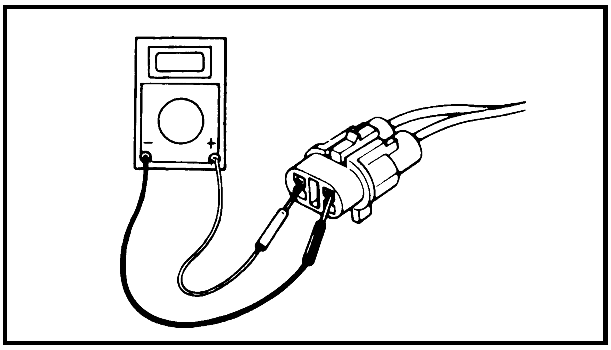


### FUSE

1. Check:
   - Fuse broken
     Broken → Replace.

**Fuse rating:**
**3A, 20A**

**NOTE:**
20A fuse is for main relay, engine shut-off switch and rectifier/regulator.
3A fuse is for multifunction meter and electric bilge pump.



### START SWITCH

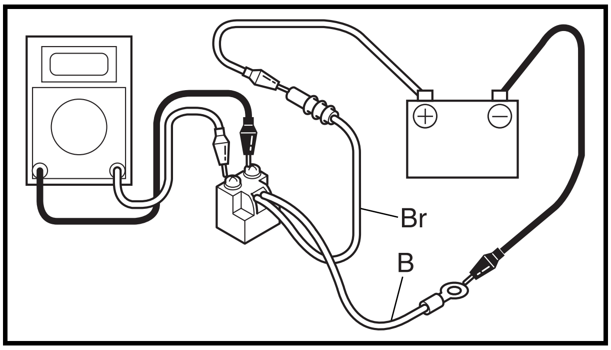
1. Check:
   - Continuity
     Out of specification → Replace.

**Start continuity (natural color coupler)**

| Clip | Position | Leads | |
|---|---|---|---|
| | | Red | Brown |
| Installed | Free | | |
| | Push | ○— | —○ |
| Removed | Free | | |
| | Push | | |

## STARTER RELAY

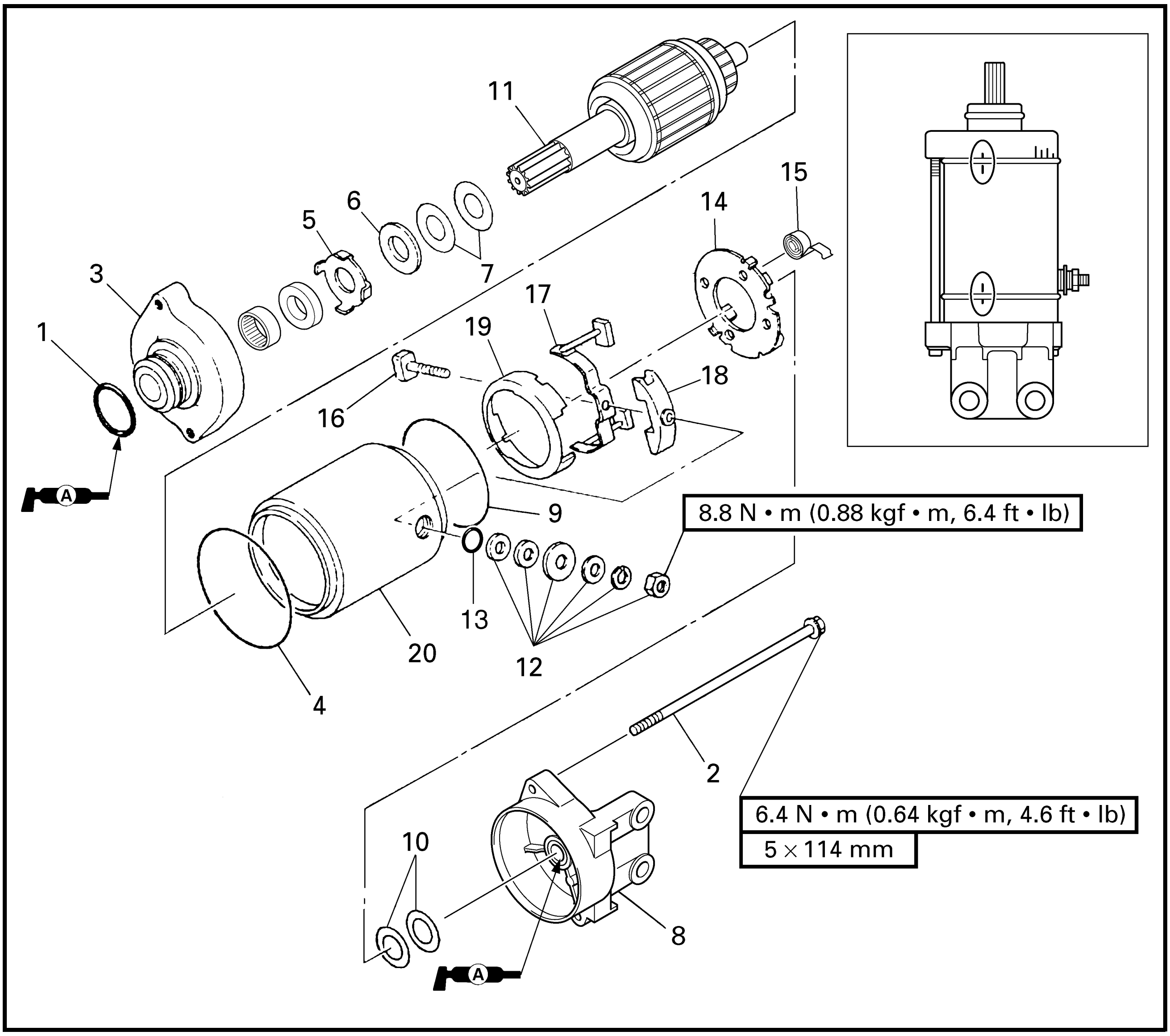
1. Inspect:
   - Brown lead terminal
   - Black lead terminal
   Loose → Tighten.




2. Check:
   - Starter relay
   Faulty → Replace.

**Checking steps:**
- Connect the tester leads between the starter relay terminals as shown.
- Connect the brown lead terminal to the positive battery terminal.
- Connect the black lead terminal to the negative battery terminal.
- Check that there is continuity between the starter relay terminals.
- Check that there is no continuity after the brown or black lead is removed.

# STARTER MOTOR
## EXPLODED DIAGRAM

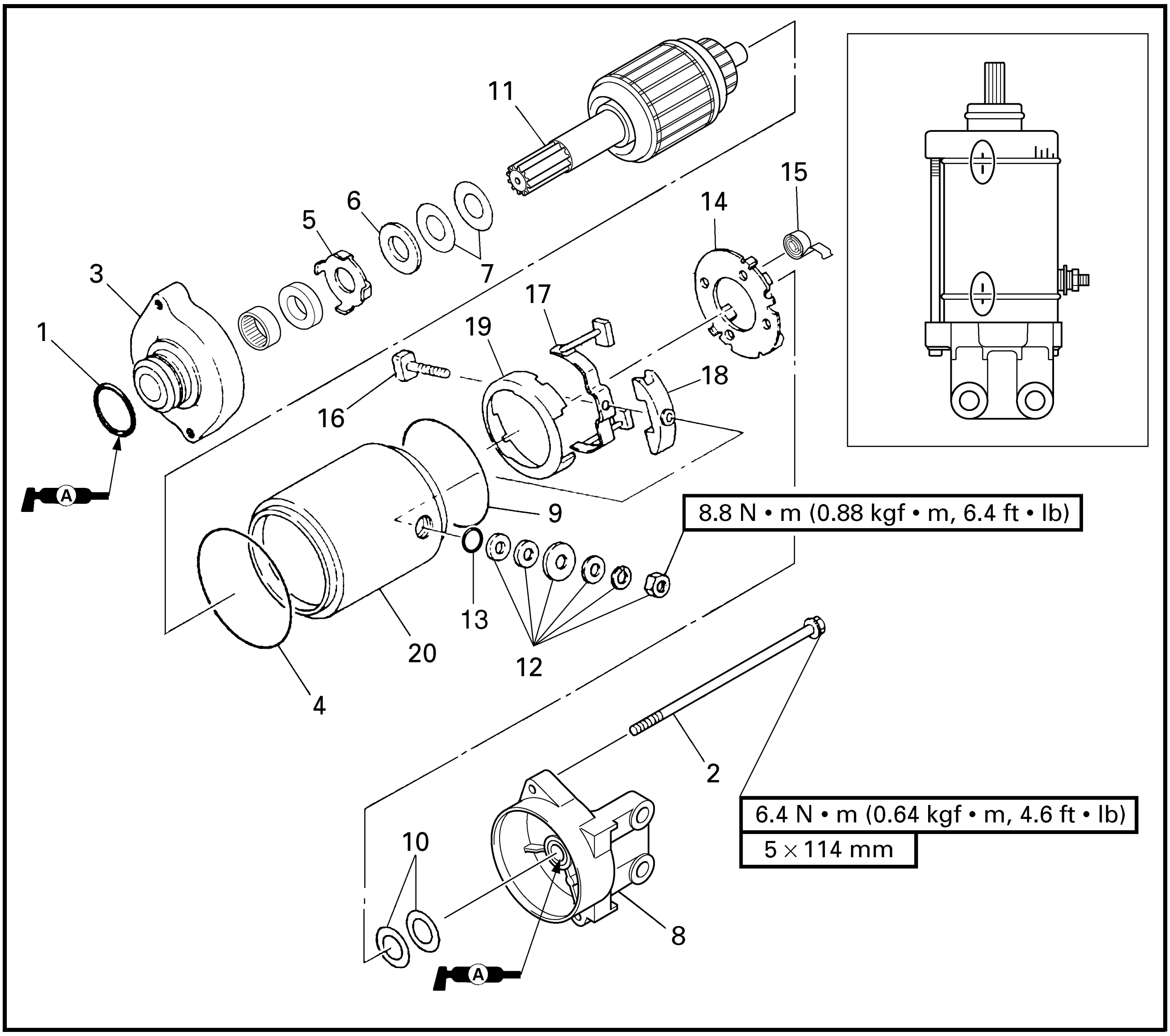



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **STARTER MOTOR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| | Starter motor | | Refer to "GENERATOR AND STARTER MOTOR" in Chapter 5. |
| 1 | O-ring | 1 | **Not reusable** |
| 2 | Bolt | 2 | |
| 3 | Starter motor front cover | 1 | |
| 4 | O-ring | 1 | **Not reusable** |
| 5 | Oil seal retainer | 1 | |
| 6 | Washer | 1 | |
| 7 | Shim | * | t = 0.2 mm, 0.5 mm |

*: As required

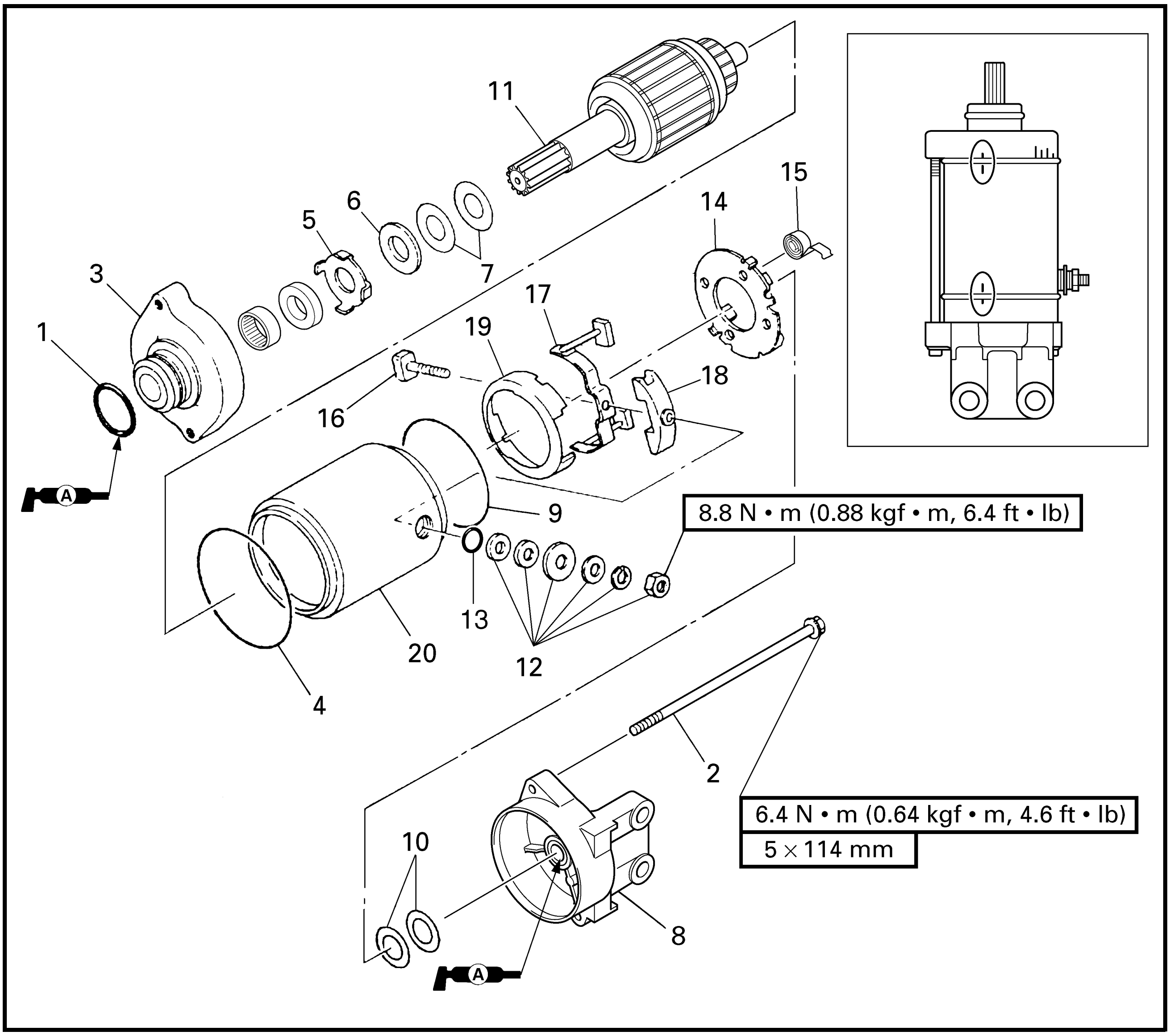
## EXPLODED DIAGRAM



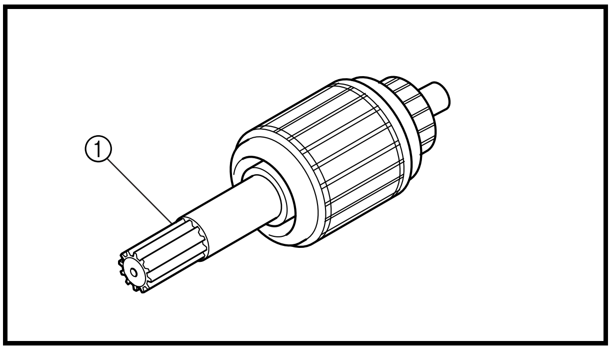

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Starter motor rear cover | 1 | |
| 9 | O-ring | 1 | Not reusable |
| 10 | Shim | * | t = 0.2 mm, 0.8 mm |
| 11 | Armature assembly | 1 | |
| 12 | Nut/spring washer/washer | 1/1/4 | |
| 13 | O-ring | 1 | Not reusable |
| 14 | Brush holder | 1 | |
| 15 | Brush spring | 4 | |
| 16 | Bolt | 1 | |
| 17 | Brush assembly | 1 | |

*: As required

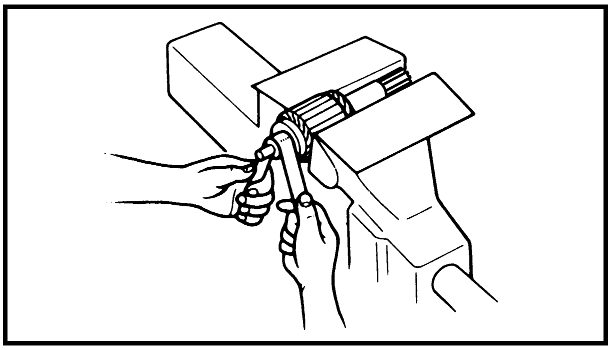
## EXPLODED DIAGRAM



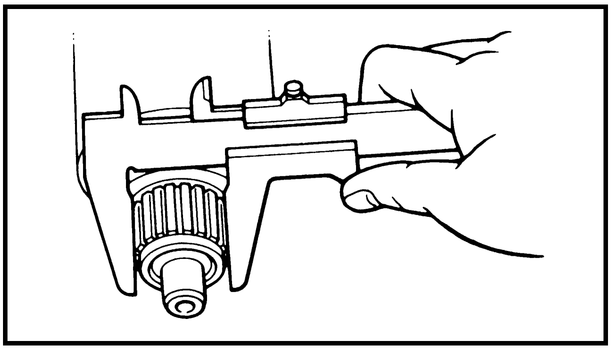

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 18 | Spacer | 1 | |
| 19 | Holder | 1 | |
| 20 | Starter motor yoke | 1 | |
| | | | Reverse the disassembly steps for assembly. |




## SERVICE POINTS
### Armature inspection
1. Inspect:
   - Armature shaft ①
     Damage/wear → Replace.

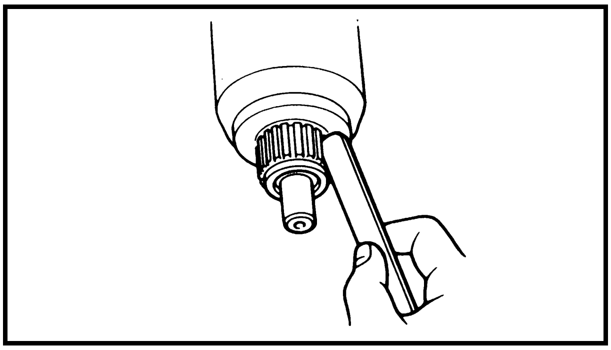


2. Inspect:
   - Commutator
     Dirt → Clean with 600 grit sandpaper.



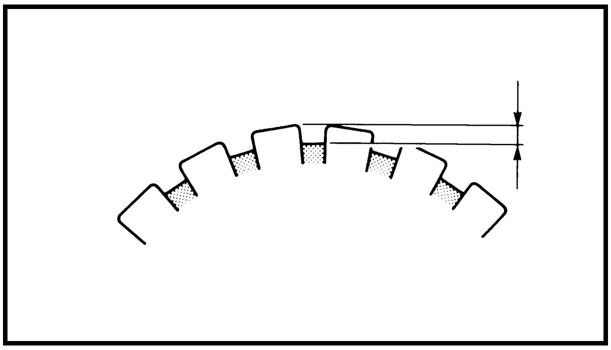
3. Measure:
   - Commutator diameter
     Out of specification → Replace.

| | |
|---|---|
| | **Min. commutator diameter:**<br>**27.0 mm (1.06 in)** |



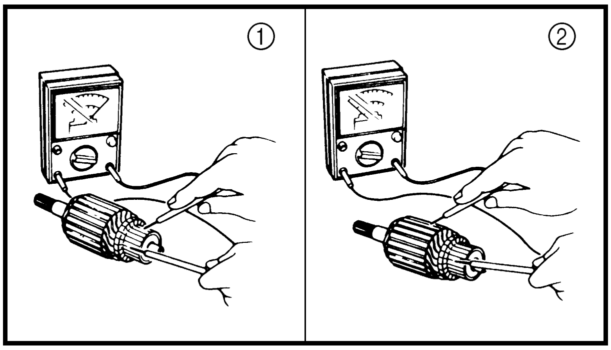
4. Check:
   - Commutator undercut
     Contaminants → Clean.

**NOTE:**
Remove all mica and metal particles with compressed air.



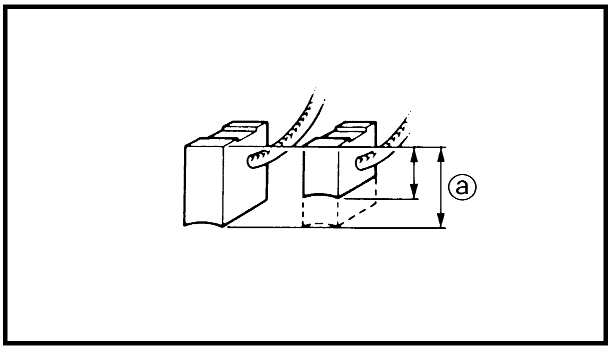
5. Measure:
   - Commutator undercut
     Out of specification → Replace.

| | |
|---|---|
| | **Min. commutator undercut:**<br>**0.2 mm (0.01 in)** |




6. Inspect:
   - Armature coil continuity
     Out of specification → Replace.

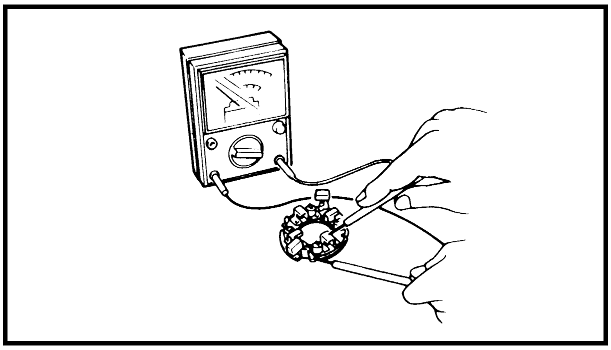
| Armature coil continuity: | |
|---|---|
| Commutator segments ① | Continuity |
| Segment - Laminations ② | No continuity |
| Segment - Armature shaft | No continuity |




**Brush holder inspection**

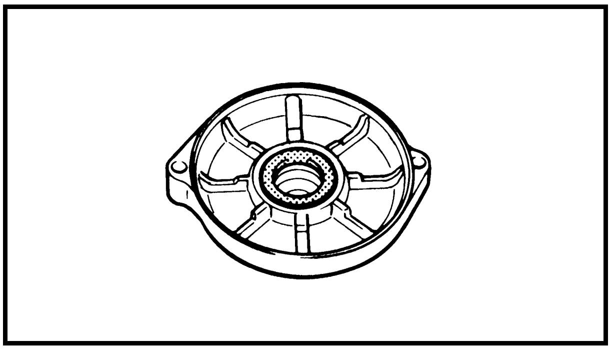
1. Measure:
   - Brush length ⓐ
     Out of specification → Replace.

| Min. brush length: 6.5 mm (0.26 in) |
|---|



2. Check:
   - Brush holder continuity
     Out of specification → Replace.

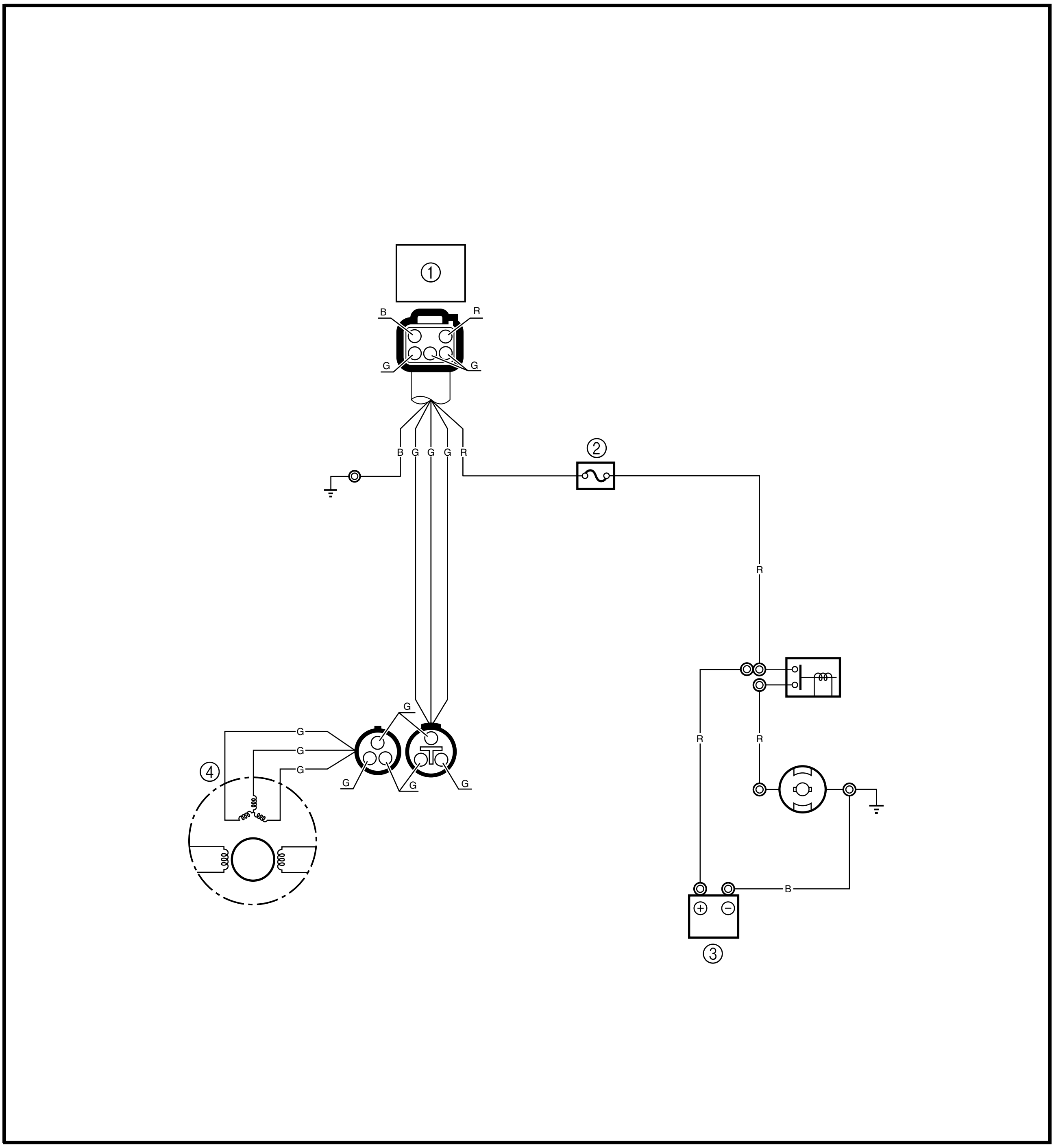
| Brush holder continuity: | |
|---|---|
| Brush holder - Base | No continuity |



**Starter motor front cover inspection**

1. Inspect:
   - Starter motor front cover oil seal
     Damage/wear → Replace the starter motor front cover.

# CHARGING SYSTEM
## WIRING DIAGRAM




① Rectifier/regulator
② Fuse (20A)
③ Battery
④ Lighting coil

B : Black
G : Green
R : Red

## FUSE

Refer to “STARTING SYSTEM”.

## BATTERY

Refer to “ELECTRICAL” in Chapter 3.

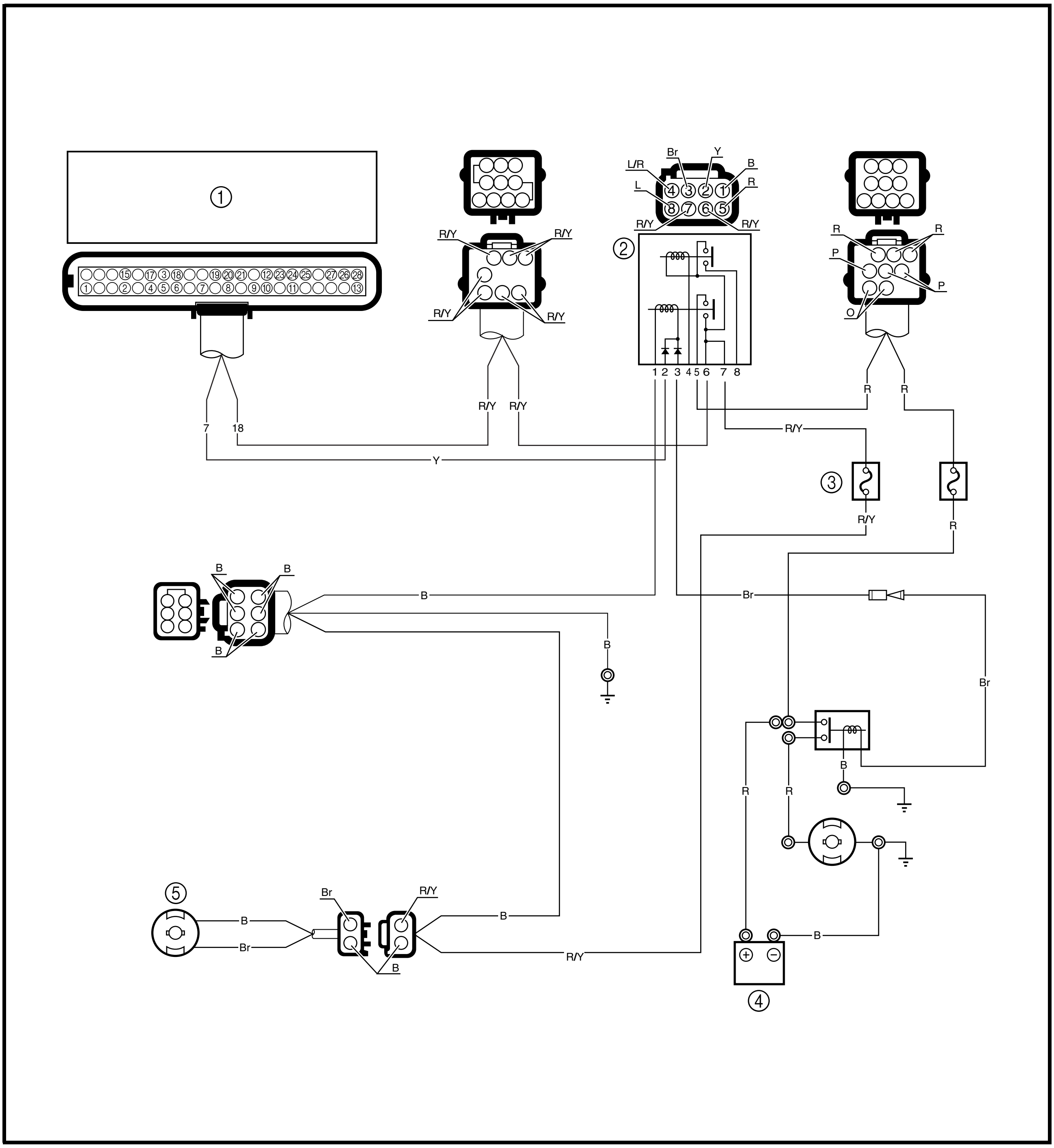
## LIGHTING COIL

Refer to “IGNITION SYSTEM”.

## RECTIFIER/REGULATOR

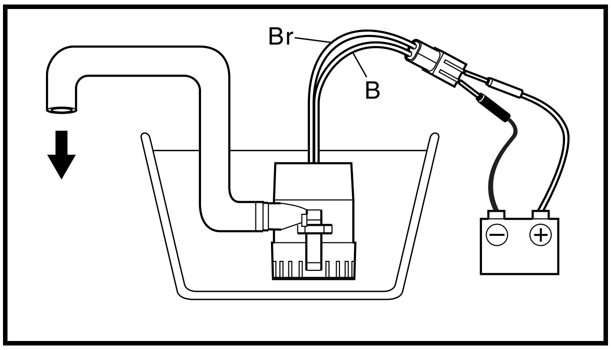
Refer to “IGNITION SYSTEM”.

# ELECTRIC BILGE PUMP
## WIRING DIAGRAM




① ECM
② Main and fuel pump relay
③ Fuse (3A)
④ Battery
⑤ Electric bilge pump

B : Black
Br : Brown
R : Red
Y : Yellow
R/Y : Red/yellow

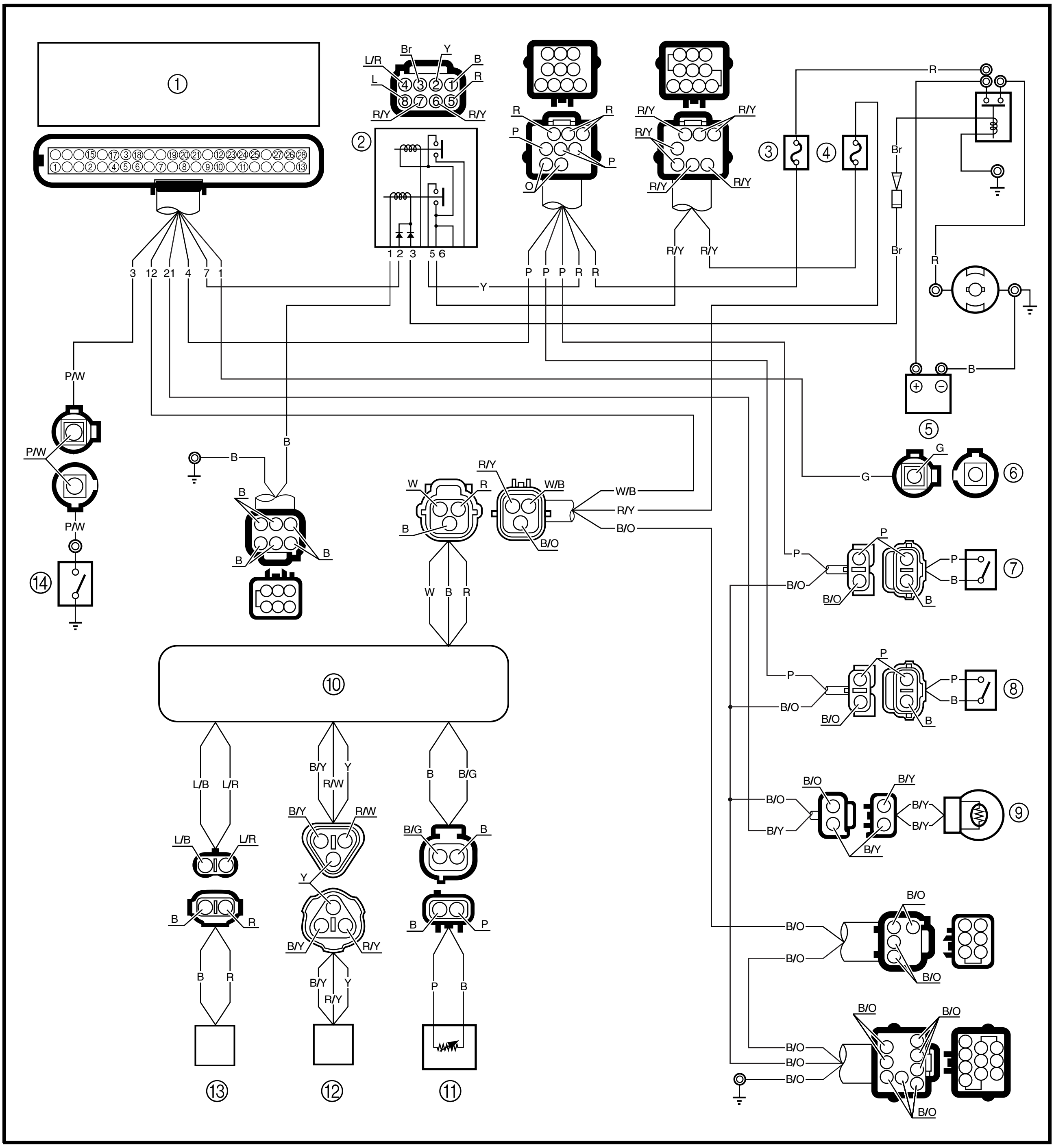



## ELECTRIC BILGE PUMP

1. Check:
   - Electric bilge pump operation
     Incorrect → Replace.

**Checking steps:**
- Suspend the electric bilge pump in a container filled with water.
- Connect the brown lead terminal to the positive battery terminal.
- Connect the black lead terminal to the negative battery terminal.
- Check the water flows from the electric bilge pump hose.

# INDICATION SYSTEM
## WIRING DIAGRAM




① ECM
② Main and fuel pump relay
③ Fuse (20A)
④ Fuse (3A)
⑤ Battery
⑥ Tacho pulse
⑦ Thermoswitch (exhaust)
⑧ Thermoswitch (engine)
⑨ Engine temperature sensor
⑩ Multifunction meter
⑪ Fuel sender
⑫ Speed sensor
⑬ Buzzer
⑭ Oil pressure switch

B : Black
Br : Brown
G : Green
O : Orange
P : Pink
R : Red
W : White
Y : Yellow
B/O : Black/orange
B/Y : Black/yellow
P/W : Pink/white
R/Y : Red/yellow
W/B : White/black

### FUSE
Refer to “STARTING SYSTEM”.

### BATTERY
Refer to “ELECTRICAL” in Chapter 3.

### LIGHTING COIL
Refer to “IGNITION SYSTEM”.

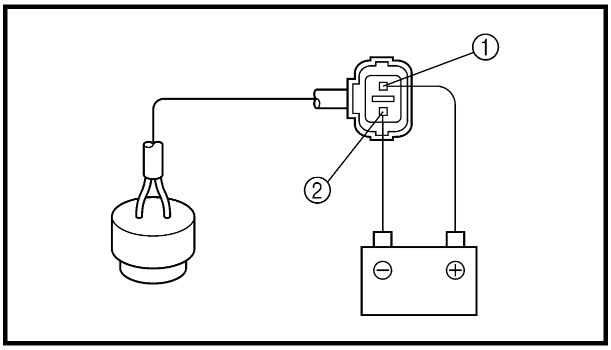
### RECTIFIER/REGULATOR
Refer to “IGNITION SYSTEM”.

### ECM
Refer to “IGNITION SYSTEM”.

### ENGINE TEMPERATURE SENSOR
Refer to “IGNITION SYSTEM”.

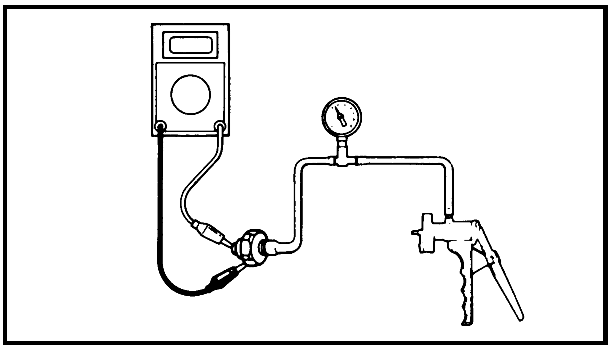
### THERMOSWITCH (ENGINE)
Refer to “IGNITION SYSTEM”.

### THERMOSWITCH (EXHAUST)
Refer to “IGNITION SYSTEM”.



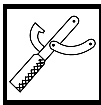

### BUZZER
1. Check:
   - Buzzer
     Buzzer does not sound → Replace.

| **Checking steps:**<br>• Connect the battery (12 V) to the buzzer coupler as shown. |
|---|
| **Battery positive terminal →<br>Red (R) terminal ①<br>Battery negative terminal →<br>Black (B) terminal ②** |

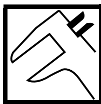


## OIL PRESSURE SWITCH

1. Measure:
   - Oil pressure switch continuity
     Out of specification → Replace.



**Vacuum/pressure pump gauge set:**
**YB-35956-A/90890-06756**



**Oil pressure switch continuity pressure:**
**128 kPa (1.28 kgf/cm$^2$, 18.2 psi) – 166 kPa (1.66 kgf/cm$^2$, 23.6 psi)**

## MULTIFUNCTION METER

### Multifunction meter

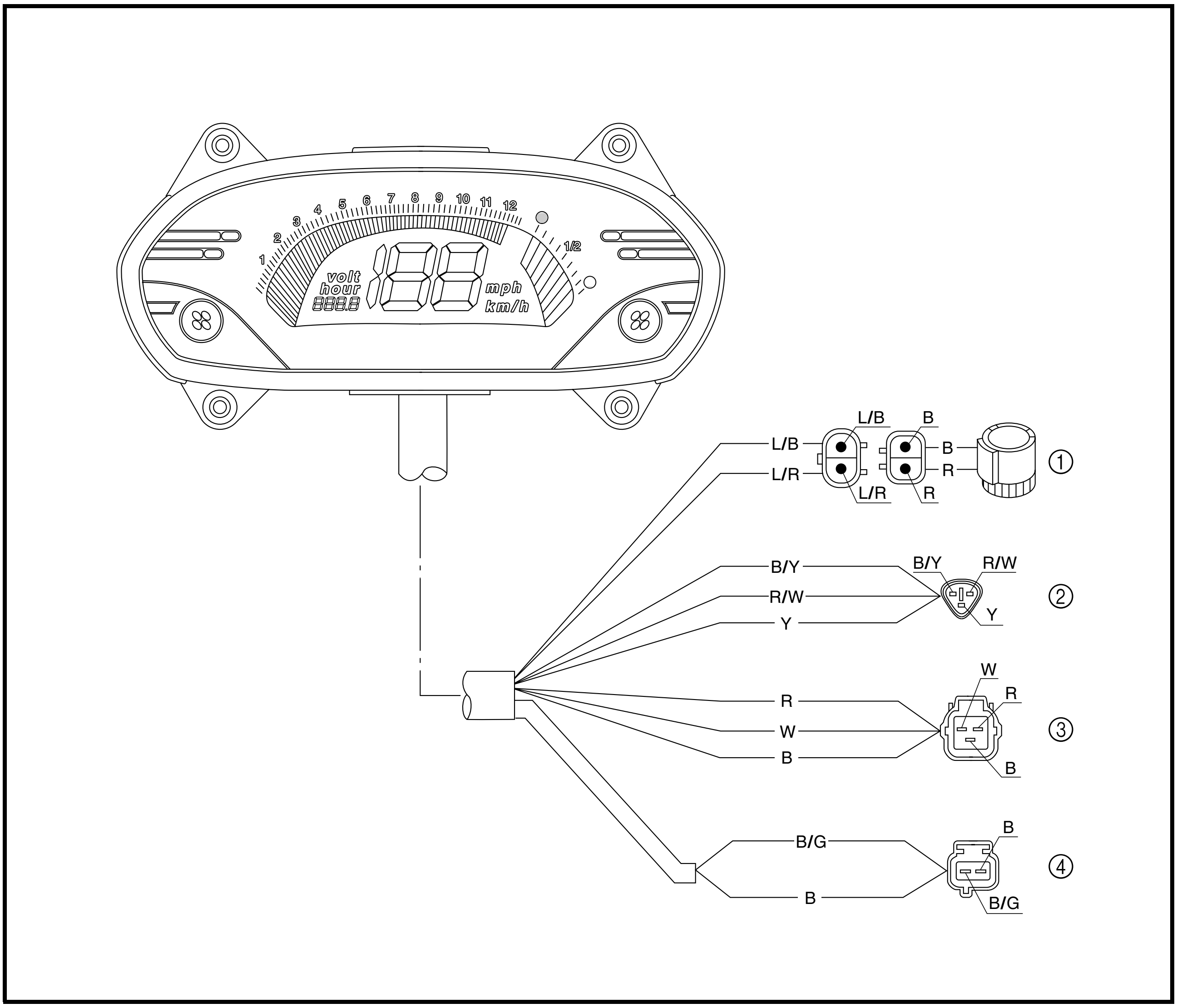
1. Check:
   - Multifunction meter
     Cracked meter housing → Replace the multifunction meter.
     Meter is fogged/shows signs of water intrusion → Replace the multifunction meter.

## MULTIFUNCTION METER REMOVAL

Refer to "STEERING CONSOLE COVER" in Chapter 8.

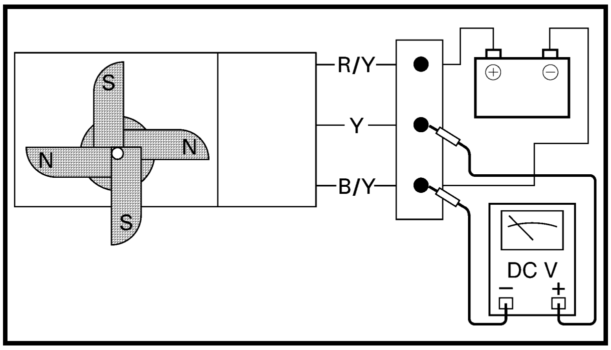
**Display function**

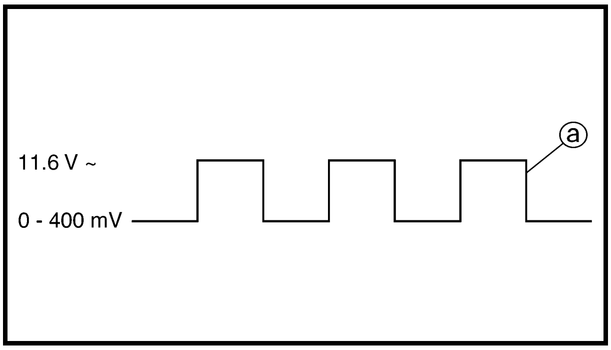
1. Check:
   - Display function
     Not operate → Replace the multifunction meter.




① Buzzer
② Speed sensor
③ ECM
④ Fuel sender

B : Black
R : Red
W : White
Y : Yellow
B/G : Black/green
B/Y : Black/yellow
L/B : Blue/black
L/R : Blue/red
R/W : Red/white




**Speedometer display**

1. Check:
   - Speedometer display
     Does not display → Measure the speed sensor output voltage and pulses.
     Without specification → Replace the multifunction meter.
2. Measure:
   - Speed sensor output voltage and pulses
     Out of specification → Repair or replace.

**Speed sensor output voltage (dependant on the paddle wheel position):**
**Less than 400 mV/**
**More than 11.6 V**
**Output pulse:**
**2 pulses/one-full turn**

**Measurement steps:**
- Apply DC 12 voltage to the white color three-pin connector (between the red/yellow and black/yellow leads).
- Rotate the paddle wheel by hand and measure the voltage between the black and yellow leads.

**NOTE:**
As the paddle wheel is rotated, a square-wave voltage signal ⓐ is produced.

- Two pulses occur every time the paddle wheel makes one-full turn.

**Tachometer display**

1. Check:
   - Tachometer display
     Does not display → Check the engine speed using the "Engine monitor" of the Yamaha Diagnostic System.
     Replace the multifunction meter.

**Hour meter display**

1. Check:
   - Hour meter display
     Does not display → Replace the multifunction meter.

**Voltage meter display**

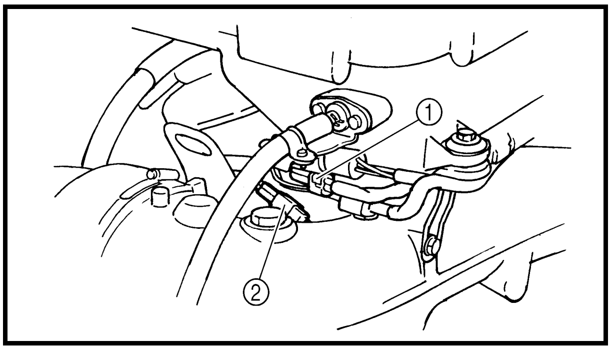
1. Check:
   - Voltage meter display
     Does not display → Check the battery voltage using the "Engine monitor" of the Yamaha Diagnostic System.
     Replace the multifunction meter.

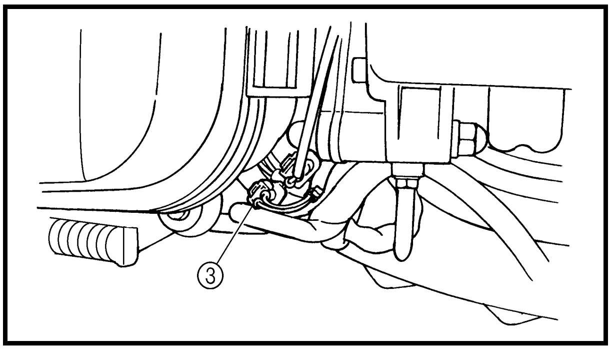
**Low oil pressure warning indicator**

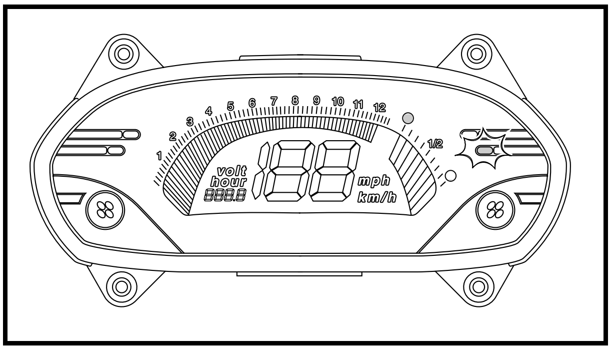
1. Check:
   - Low oil pressure warning indicator
     No operating → Check the oil pressure switch using the "Engine monitor" of the Yamaha Diagnostic System.
     Replace the multifunction meter.

**Fuel level meter display and fuel warning indicator**

1. Check:
   - Fuel level meter display and fuel warning indicator
     Does not display or not operating → Measure the fuel sender resistance.
     Replace the multifunction meter.
2. Measure:
   - Fuel sender
     Refer to "FUEL CONTROL SYSTEM".



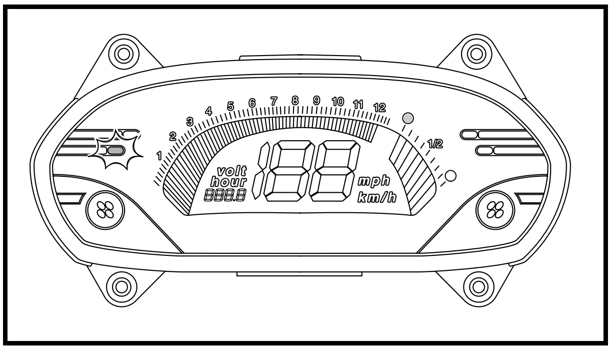




### Overheat warning indicator

1. Check:
   - Overheat warning indicator
     Not operating → Replace the multifunction meter.

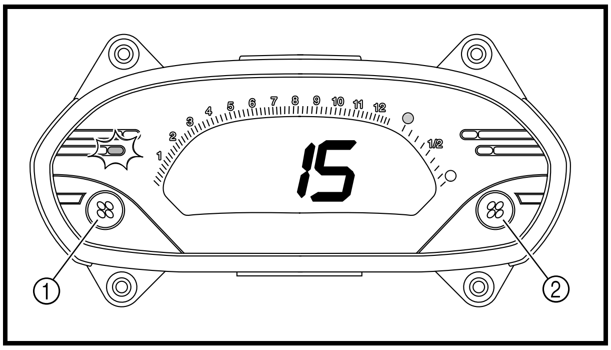
**Checking steps:**
- Disconnect the thermoswitch (engine) connector ① (blue) or engine temperature sensor connector ② (black) or thermoswitch (exhaust) ③ connector.
- Connect the jumper lead to the female terminal of the disconnected connector.
- Check that the multifunction meter overheat warning indicator comes on and the buzzer sounds.




### Engine trouble warning indicator

1. Check:
   - Engine trouble warning indicator
     Not operating → Replace the multifunction meter.

**Checking steps:**
- Remove the coupler of the sensor indicated in the multifunction meter.
- Check if “Irregular” is indicated in the Diagnosis Record of the Yamaha Diagnostic System.
- Start the engine and check that the engine check warning indicator comes on and the buzzer sounds.



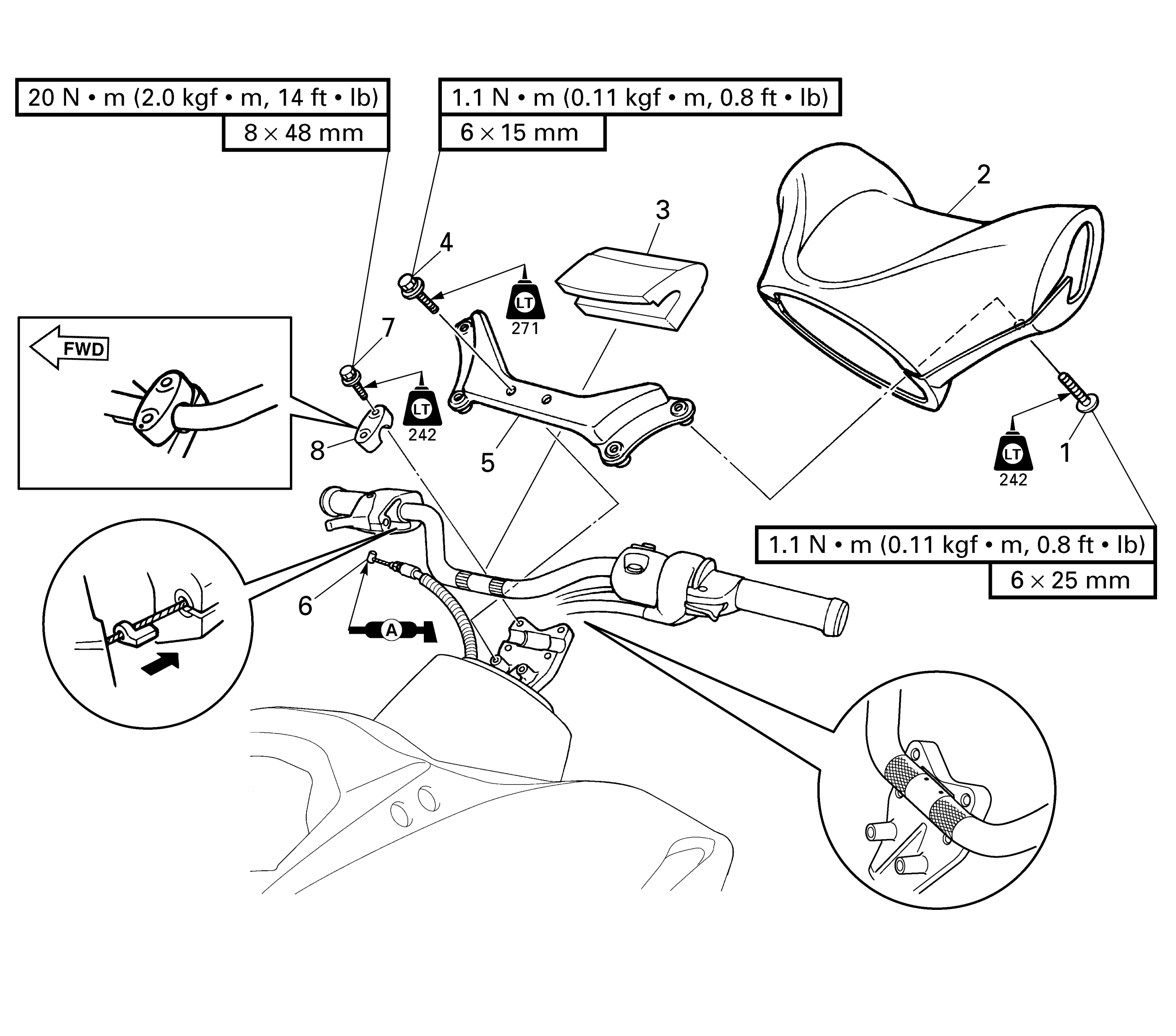

**Diagnostic display**

1. Check:
   - Diagnostic display
     Does not display → Replace the multifunction meter.

**Checking steps:**
- Remove the coupler of the sensor indicated in the multifunction meter.
- Check if “Irregular” is indicated in the Diagnosis Record of the Yamaha Diagnostic System.
- Start the engine and check that the engine check warning indicator comes on and the buzzer sounds.
- Press the hour meter/voltmeter display select switch ① and the speedometer display switch ② for 8 seconds and check if an error code is indicated on the multifunction meter.

# CHAPTER 8
# HULL AND HOOD

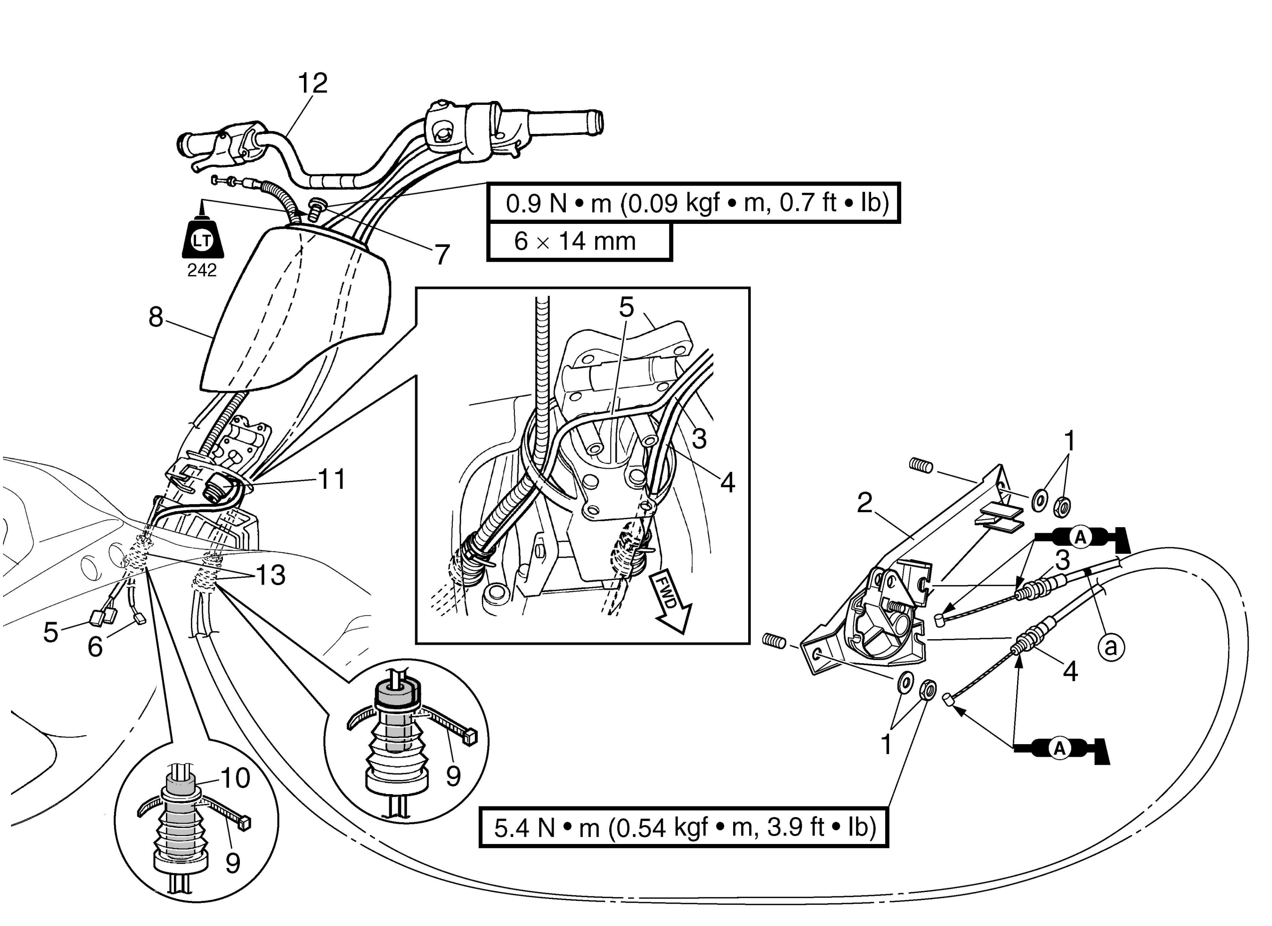
# HANDLEBAR
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **HANDLEBAR COVER REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Screw | 4 | |
| 2 | Handlebar cover | 1 | |
| 3 | Pad | 1 | |
| 4 | Bolt | 2 | **NOTE:** |
| 5 | Handlebar cover stay | 1 | Position the corrugated tube for the throttle cable as shown in the illustration so that the tube attaches to the end of the outer throttle cable. |
| 6 | Throttle cable | 1 | |
| 7 | Bolt | 4 | |
| 8 | Upper handlebar holder | 2 | |
| | | | Reverse the removal steps for installation. |

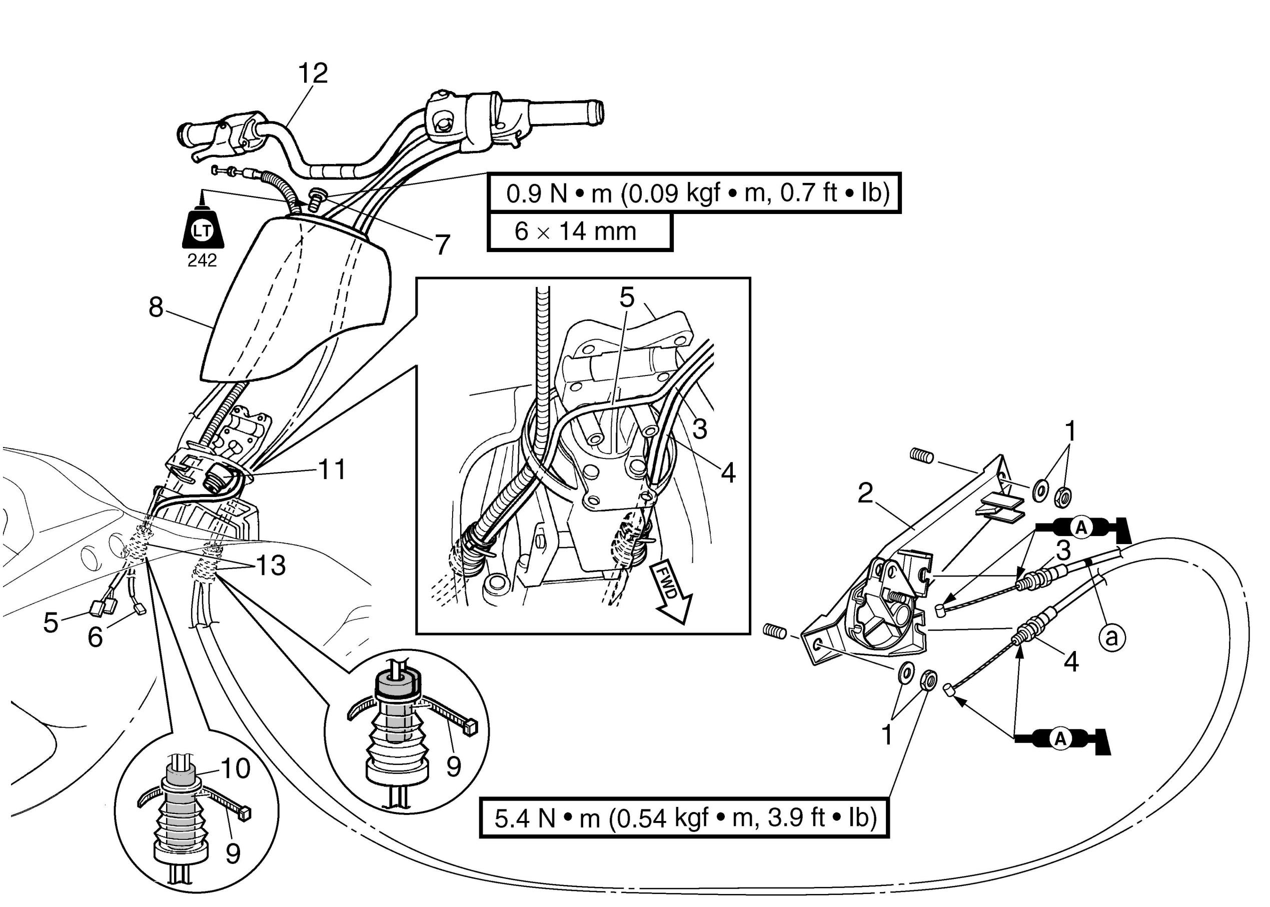
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

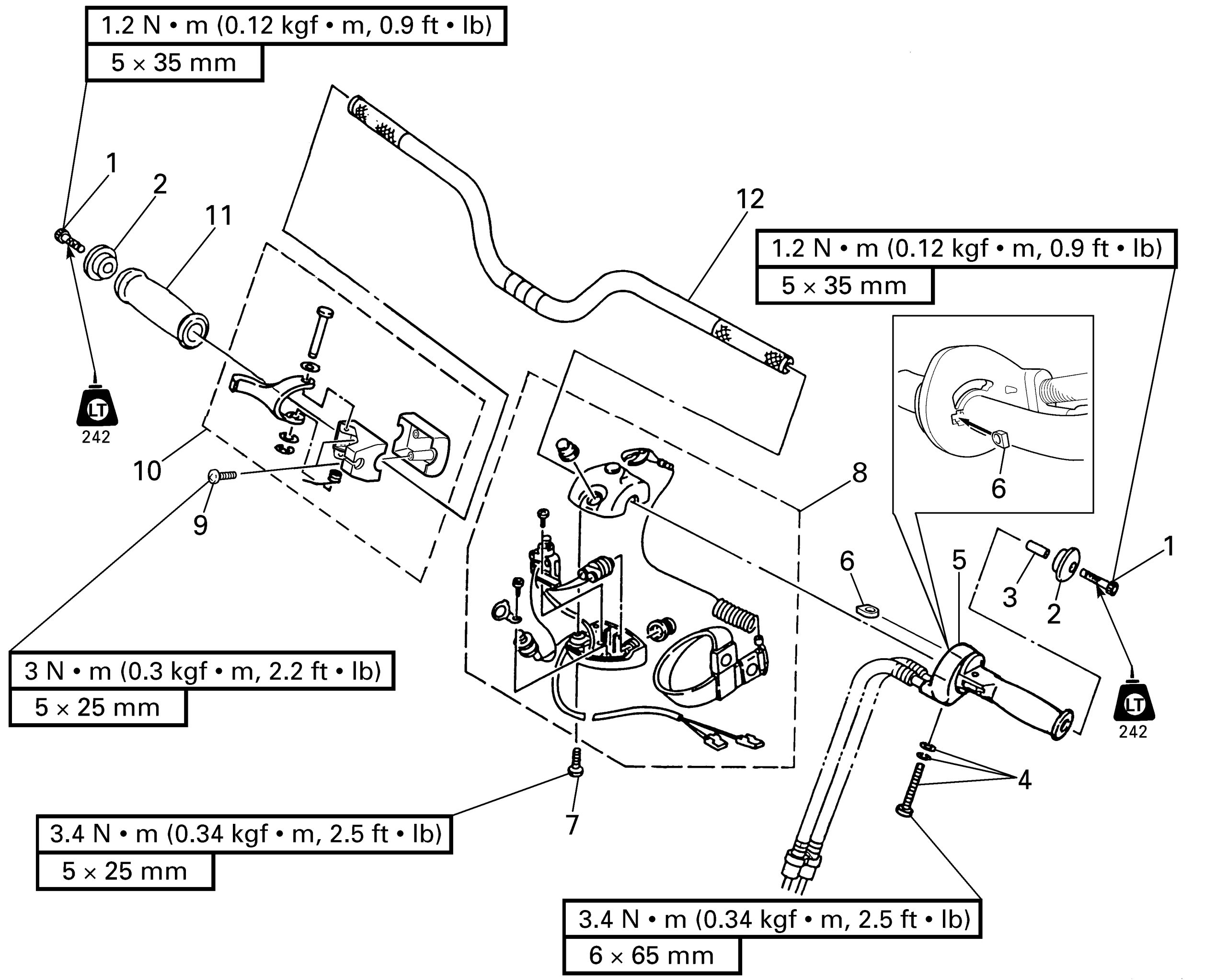
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **HANDLEBAR REMOVAL** | | Follow the left "Step" for removal. |
| | QSTS cable (to jet thrust nozzle) | | Refer to "REMOTE CONTROL CABLES AND SPEED SENSOR LEAD". |
| 1 | Nut/washer | 2/2 | |
| 2 | QSTS converter | 1 | |
| 3 | QSTS cable 2 | 1 | with white tape ⓐ |
| 4 | QSTS cable 1 | 1 | |
| 5 | Handlebar switch coupler | 2 | |
| 6 | Buzzer coupler | 1 | |
| 7 | Screw | 4 | |
| 8 | Handle boss cover | 1 | |
| 9 | Band | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 10 | Hose packing | 1 | **Not reusable** |
| 11 | Buzzer | 1 | |
| 12 | Handlebar assembly | 1 | **NOTE:** • Pass the QSTS cable and handlebar switch lead through the handle boss cover, and then install the handlebar assembly. • Install the sponges of the QSTS cables as shown and make sure that the grommet is installed to the deck securely. |
| 13 | Grommet | 2 | Reverse the removal steps for installation. |

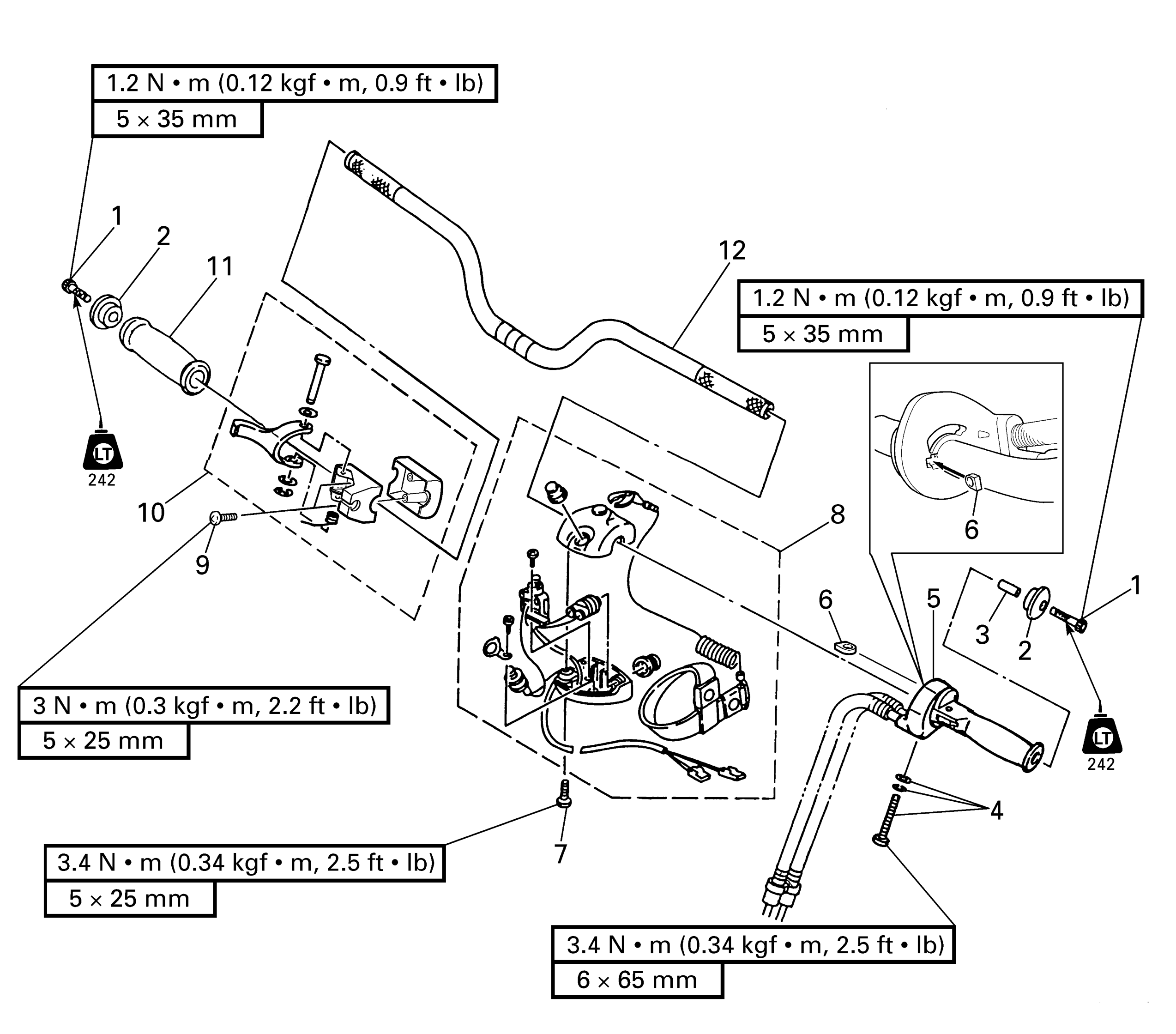
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **HANDLEBAR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt | 2 | |
| 2 | Grip end | 2 | |
| 3 | Spacer | 1 | |
| 4 | Screw/spring washer/washer | 1/1/1 | |
| 5 | QSTS grip assembly | 1 | |
| 6 | Special nut | 1 | |
| 7 | Screw | 2 | **NOTE:** Tighten the screw from the engine stop switch side. |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Handlebar switch assembly | 1 | |
| 9 | Screw | 2 | |
| 10 | Throttle lever assembly | 1 | |
| 11 | Handlebar grip | 1 | **NOTE:** Apply adhesive to the handlebar and the inner surface of the handlebar grip. |
| 12 | Handlebar | 1 | |
| | | | Reverse the disassembly steps for assembly. |

## SERVICE POINTS

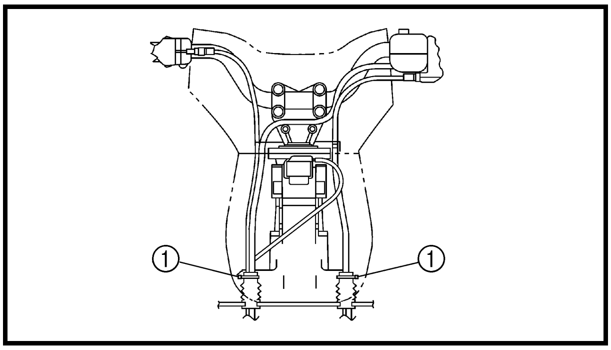
### Handlebar inspection

1. Inspect:
   - Handlebar
     Bends/cracks/damage → Replace.

### Handlebar switch inspection

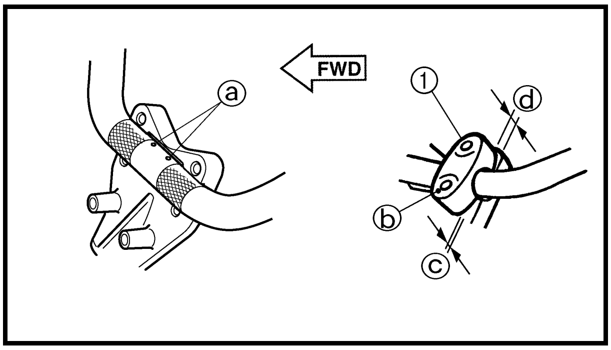
Refer to "STARTING SYSTEM" in Chapter 7.

### Handlebar assembly installation




1. Install:
   - Bands ①

**NOTE:**
After inserting the QSTS cables, buzzer lead, handlebar switch lead and throttle cable into the grommets, tie the end of grommets with the bands.



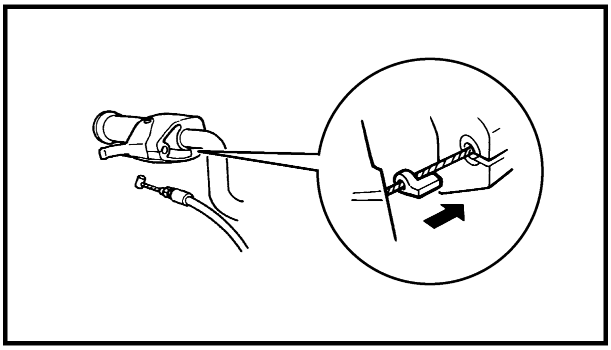

2. Install:
   - Upper handlebar holder ①

**NOTE:**
- Align the punch marks ⓐ on the handlebar with the top surface of the handlebar holder.
- The upper handlebar holder should be installed with the punch mark ⓑ facing forward.

**CAUTION:**

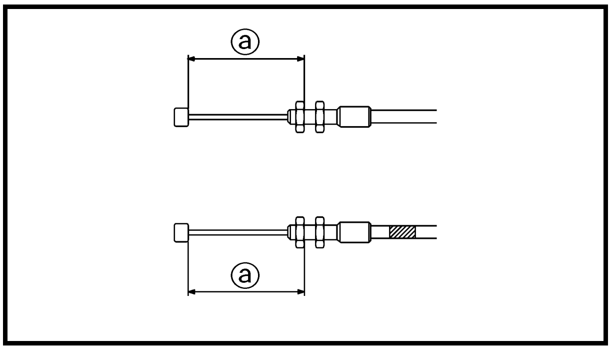
**Clearance ⓒ should be narrower than clearance ⓓ.**

**Reference clearance:**
**ⓒ: 1.5 mm (0.06 in)**
**ⓓ: 3.5 mm (0.14 in)**



3. Install:
   - Throttle cable

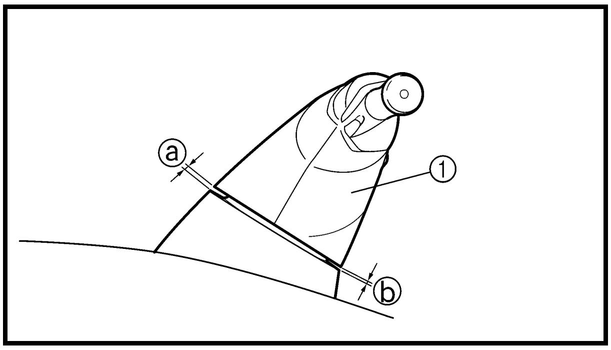
**NOTE:**
Fit the seal into the groove in the bracket.




4. Adjust:
   - QSTS cable length ⓐ

| | |
|---|---|
| | **QSTS cable length:**<br>**72 ± 0.5 mm (2.83 ± 0.02 in)** |

**NOTE:**
- Before adjusting the QSTS cables, set the trim grip to the neutral position.
- Adjust the QSTS cable lengths ⓐ to the specified length and be sure to take up any slack.



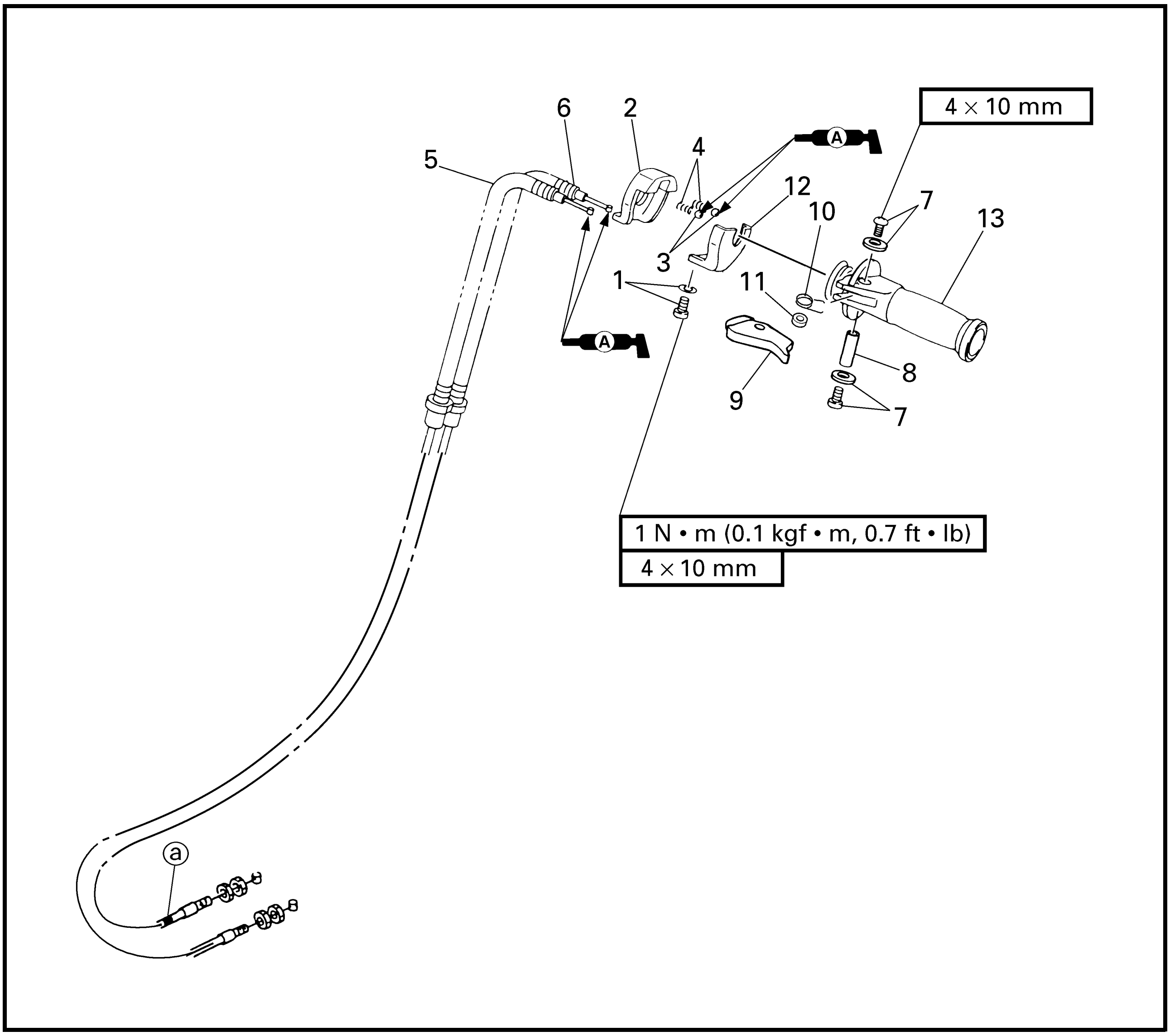

5. Install:
   - Handlebar cover ①

**NOTE:**
When the handlebar cover is in contact with the steering boss cover, adjust the handlebar mount angle so that the clearance ⓐ and ⓑ are equal.

6. Adjust:
   - Throttle cable free play
     Refer to "CONTROL SYSTEM" in Chapter 3.

7. Adjust:
   - QSTS cable
     Refer to "CONTROL SYSTEM" in Chapter 3.

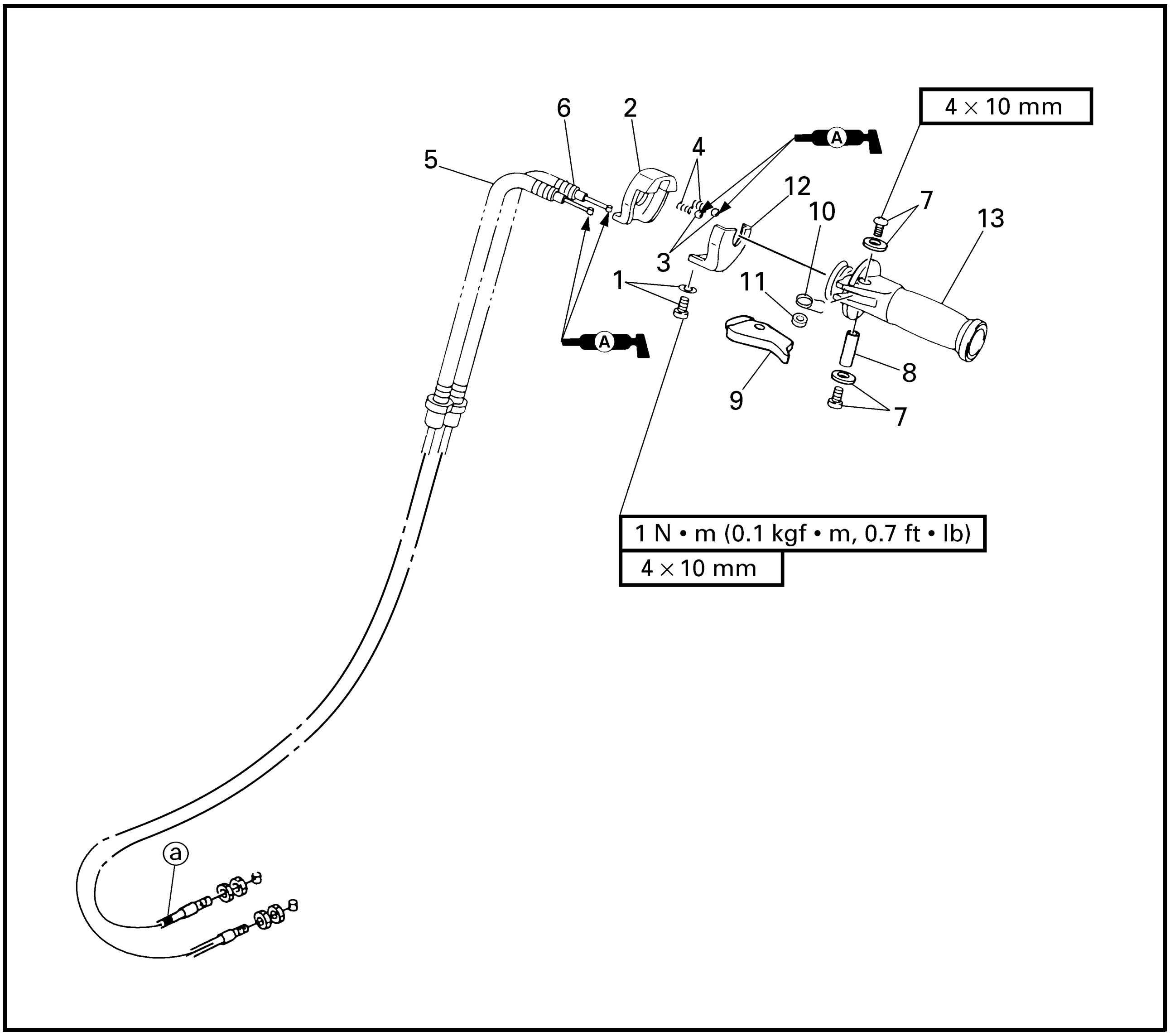
# QSTS GRIP
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **QSTS GRIP DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| | QSTS grip assembly | | Refer to "HANDLEBAR". |
| 1 | Screw/washer | 1/1 | |
| 2 | Cover | 1 | |
| 3 | Ball | 2 | |
| 4 | Spring | 2 | |
| 5 | QSTS cable 1 | 1 | |
| 6 | QSTS cable 2 | 1 | with white tape ⓐ |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Screw/washer | 2/2 | |
| 8 | Spacer | 1 | |
| 9 | QSTS shift lock lever | 1 | |
| 10 | Spring | 1 | |
| 11 | Spacer | 1 | |
| 12 | Cable housing | 1 | |
| 13 | QSTS grip | 1 | |
| | | | Reverse the disassembly steps for assembly. |

## SERVICE POINTS

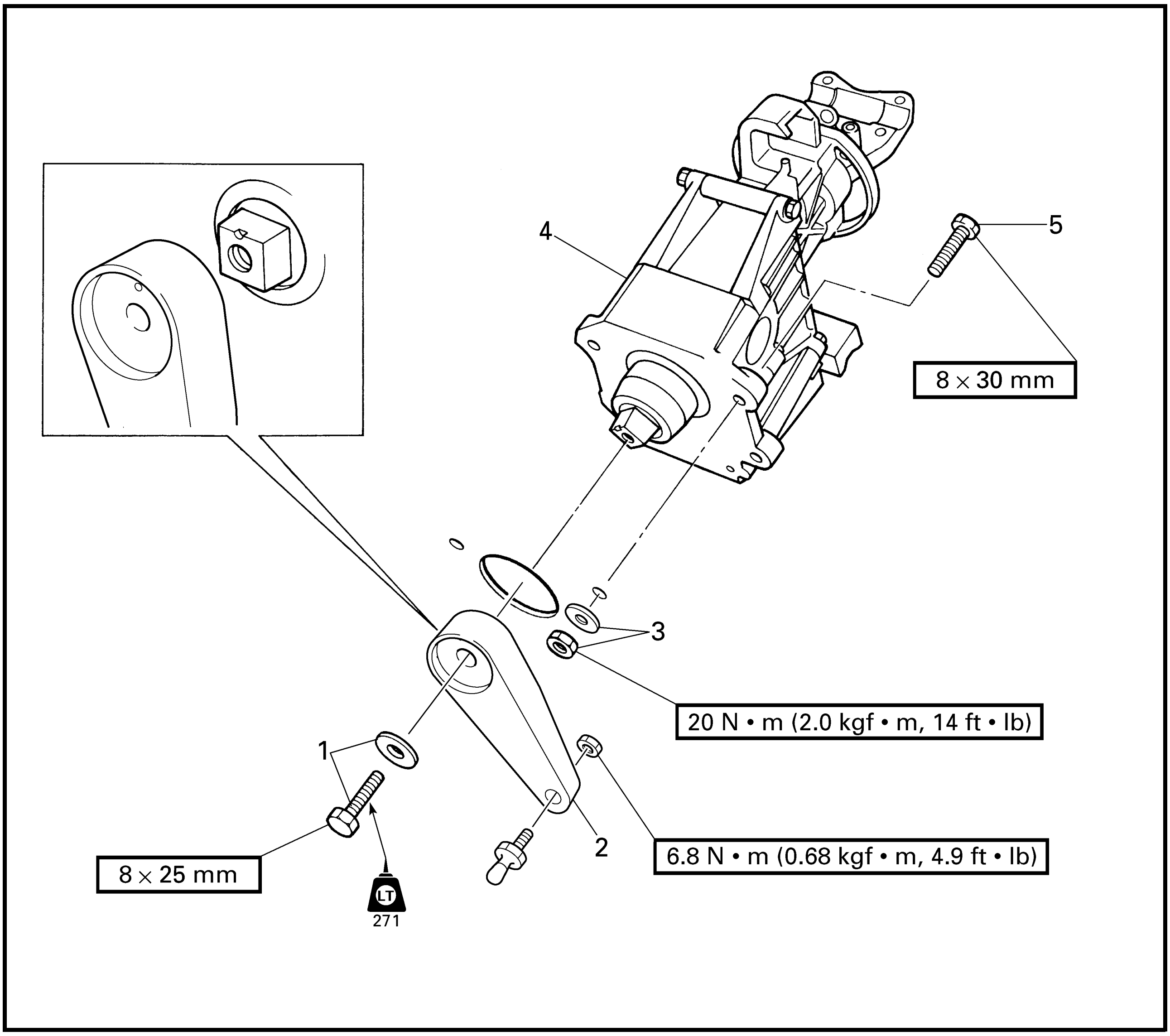
### QSTS cable inspection

1. Inspect:
   - QSTS cables
     Frays/kinks/rough movement → Replace.

### QSTS grip inspection

1. Inspect:
   - QSTS grip
     Damage/wear → Replace.

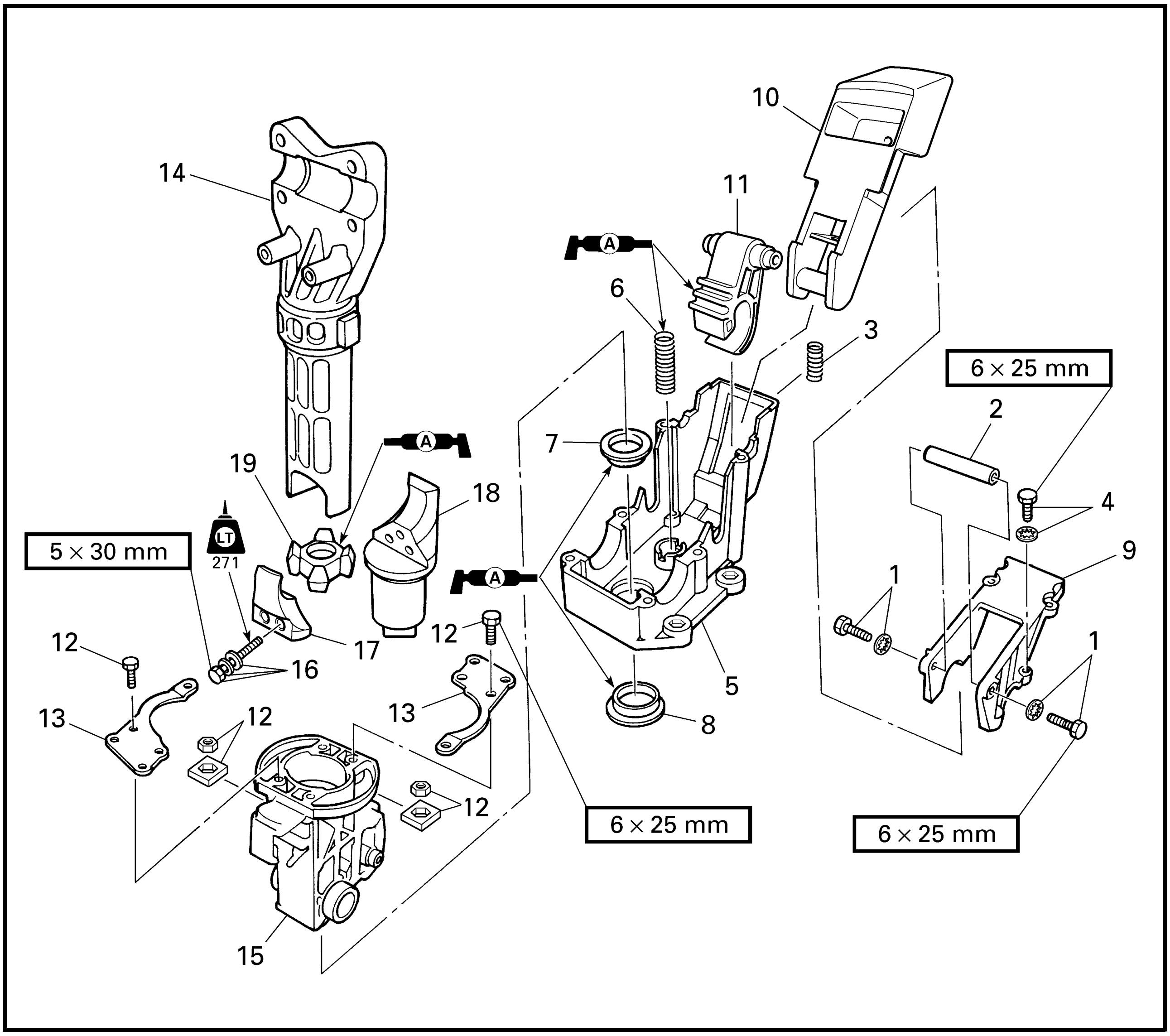
# STEERING MASTER
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **STEERING MASTER REMOVAL** | | Follow the left "Step" for removal. |
| | Steering console cover | | Refer to "STEERING CONSOLE COVER". |
| | Steering cable end | | Refer to "REMOTE CONTROL CABLES AND SPEED SENSOR LEAD". |
| 1 | Bolt/washer | 1/1 | |
| 2 | Steering arm | 1 | |
| 3 | Nut/washer | 4/4 | |
| 4 | Steering master assembly | 1 | |
| 5 | Bolt | 4 | |
| | | | Reverse the removal steps for installation. |

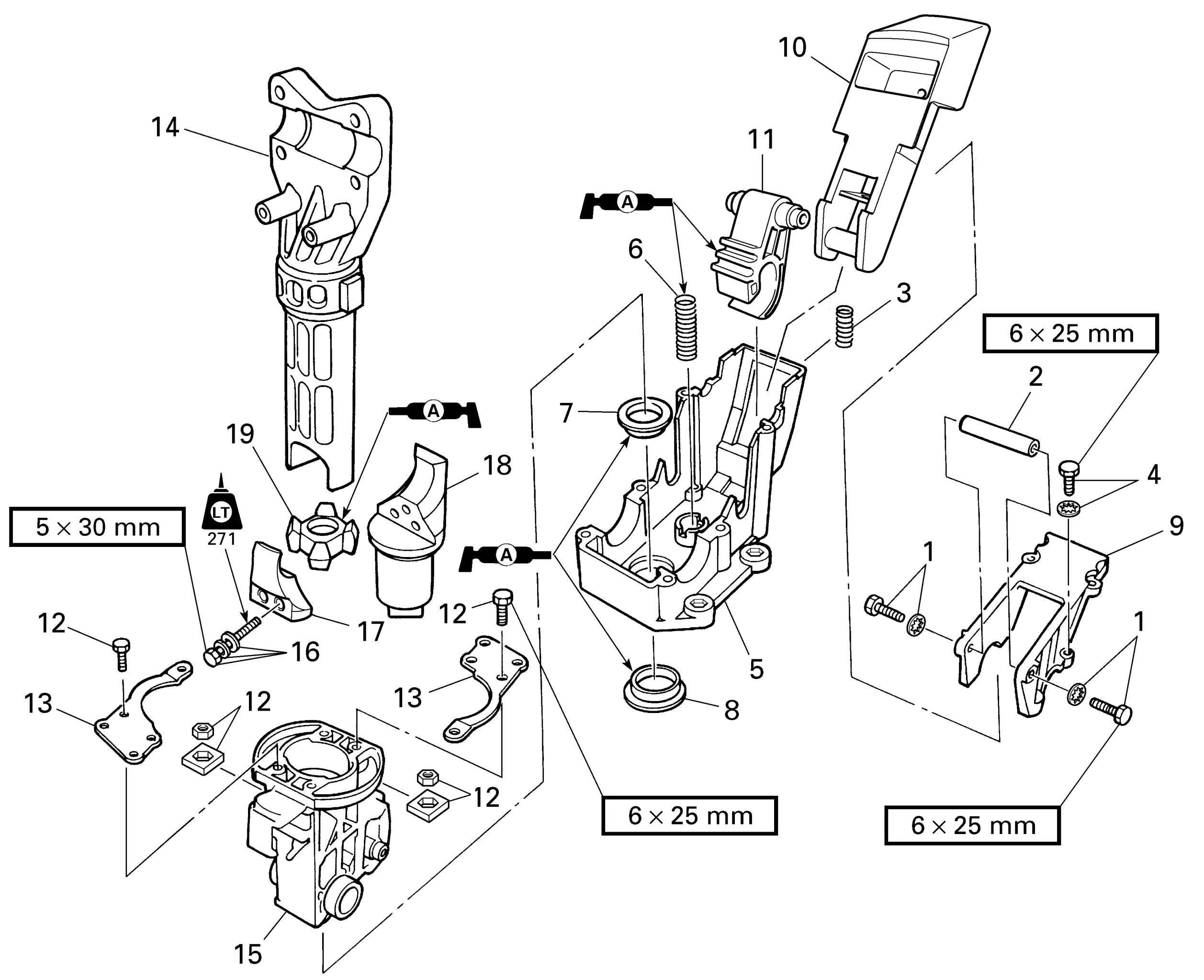
## EXPLODED DIAGRAM



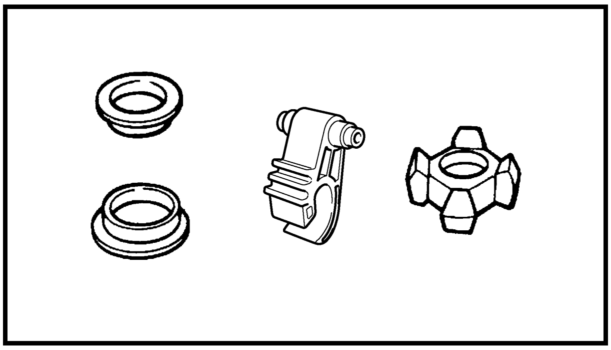

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **STEERING MASTER DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt/washer | 2/2 | |
| 2 | Stay | 1 | |
| 3 | Spring | 1 | |
| 4 | Bolt/washer | 6/6 | |
| 5 | Lower housing | 1 | |
| 6 | Spring | 1 | |
| 7 | Bushing | 1 | |
| 8 | Bushing | 1 | |
| 9 | Upper housing | 1 | |
| 10 | Tilt lever | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 11 | Tilt stopper | 1 | |
| 12 | Bolt/nut/holder | 4/4/4 | |
| 13 | Retainer | 2 | |
| 14 | Steering shaft assembly | 1 | |
| 15 | Steering tube | 1 | |
| 16 | Bolt/washer/spring washer | 2/2/2 | |
| 17 | Cap | 1 | |
| 18 | Shaft 1 | 1 | |
| 19 | Cross piece | 1 | |
| | | | Reverse the disassembly steps for assembly. |

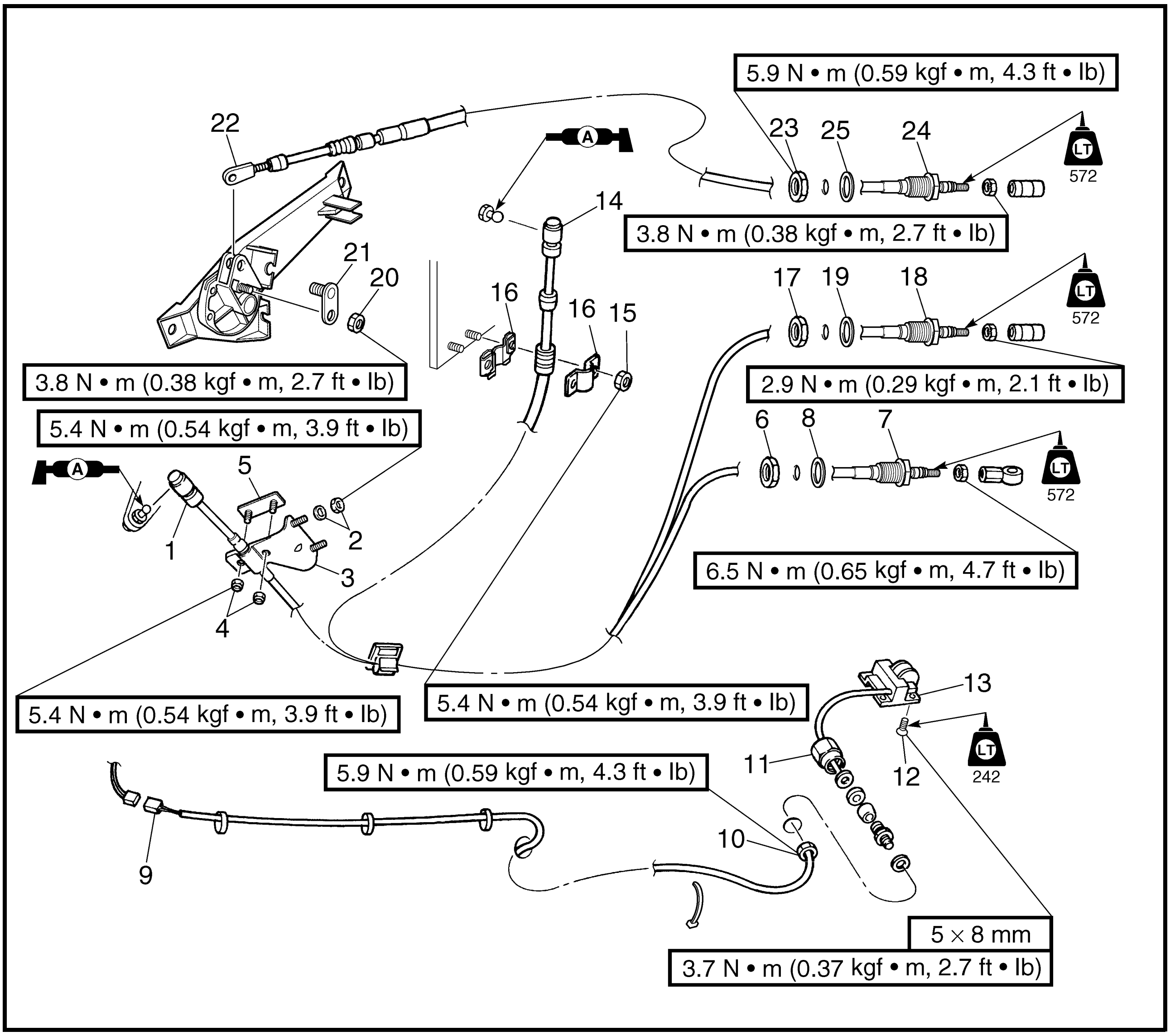


## SERVICE POINTS

### Steering master components inspection

1. Inspect:
   - Each component part
     Damage/wear → Replace the steering master.

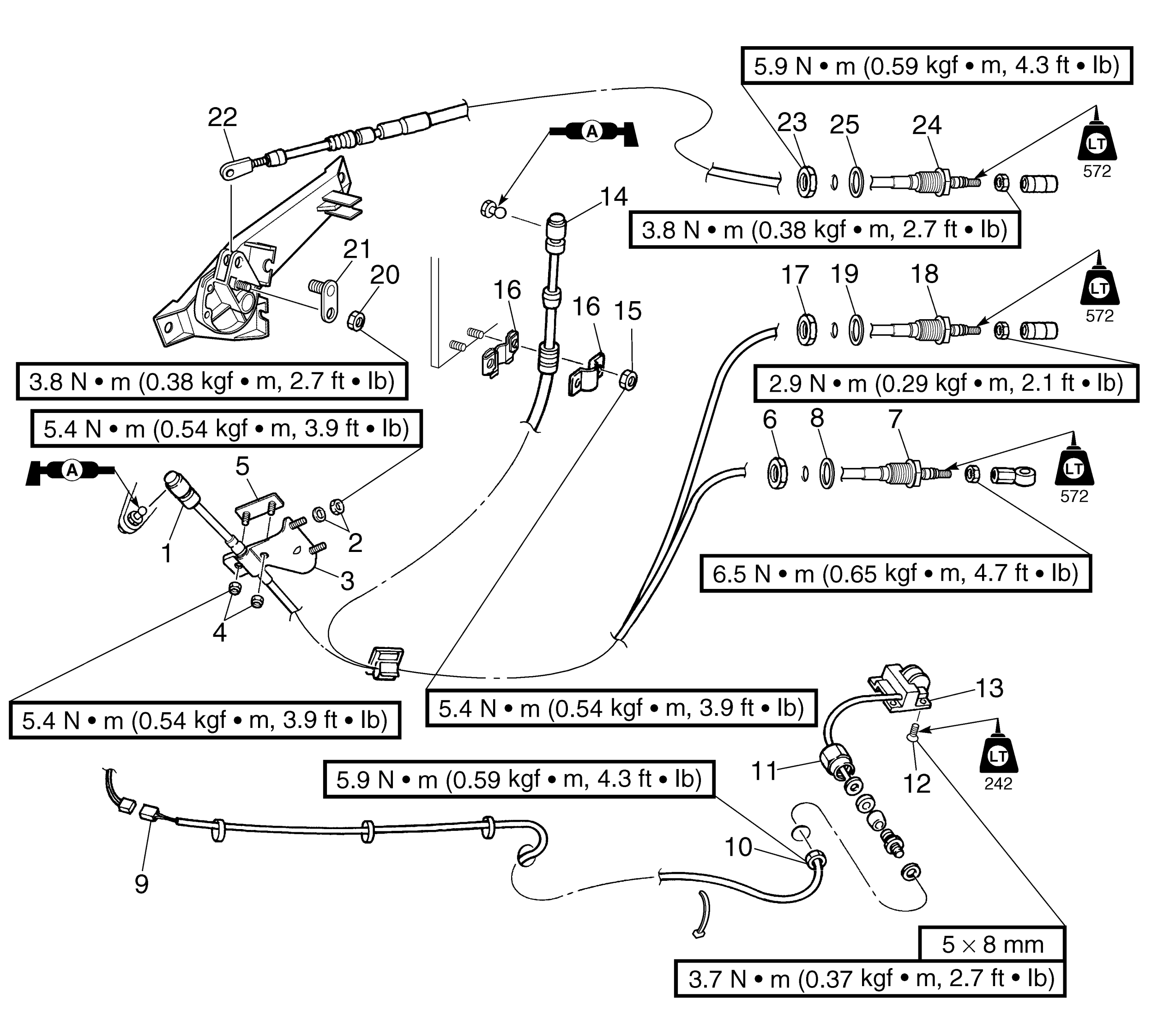
# REMOTE CONTROL CABLES AND SPEED SENSOR LEAD
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

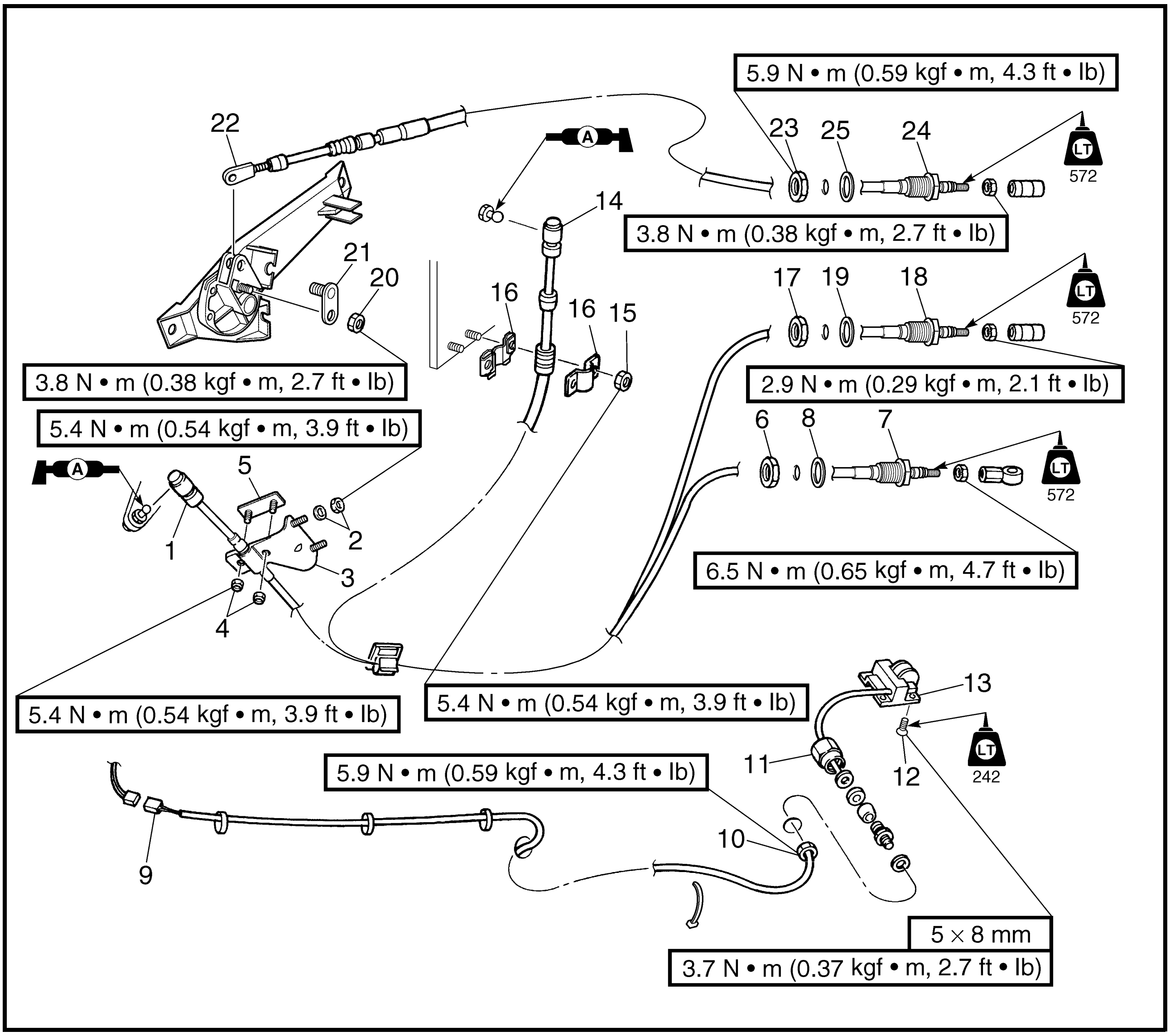
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **REMOTE CONTROL CABLES AND SPEED SENSOR LEAD REMOVAL** | | Follow the left "Step" for removal. |
| | Service lid 1 | | Refer to "FRONT HOOD". |
| | Front seat assembly | | Refer to "SEATS AND HAND GRIP". |
| | Glove compartment | | Refer to "STEERING CONSOLE COVER". |
| 1 | Steering cable end | 1 | |
| 2 | Nut/washer | 2/2 | |
| 3 | Bracket | 1 | |
| 4 | Nut | 2 | |
| 5 | Steering cable holder | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Nut | 1 | |
| 7 | Steering cable | 1 | |
| 8 | Packing | 1 | |
| 9 | Speed sensor coupler | 1 | |
| 10 | Nut | 1 | |
| 11 | Cap | 1 | |
| 12 | Screw | 4 | |
| 13 | Speed sensor | 1 | |
| 14 | Shift cable end | 1 | |
| 15 | Nut | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 16 | Shift cable holder | 2 | |
| 17 | Nut | 1 | |
| 18 | Shift cable | 1 | |
| 19 | Packing | 1 | |
| 20 | Nut | 1 | |
| 21 | Pin | 1 | |
| 22 | QSTS cable end | 1 | |
| 23 | Nut | 1 | |
| 24 | QSTS cable | 1 | |
| 25 | Packing | 1 | |
| | | | Reverse the removal steps for installation. |

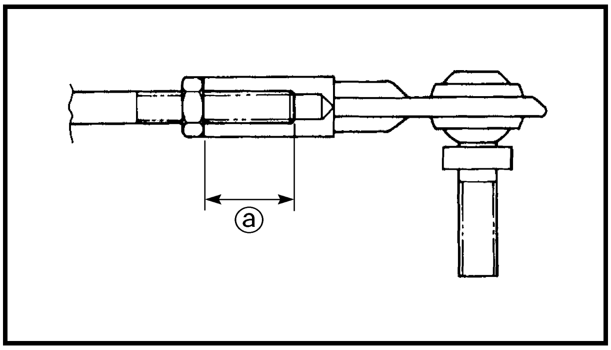
## SERVICE POINTS

**⚠ WARNING**

**When routing the cables, do not grasp the cable by the outer crimped sheath or steel end. This could deform or loosen the cable end due to extreme angles and or pressure. Always hold the cables by the outer cover below the crimp.**
**If a cable becomes damaged replace it. Never attempt to repair a damaged cable.**

### Remote control cables inspection

1. Inspect:
   - Steering cable
   - QSTS cable
   - Shift cable
     Frays/kinks/rough movement → Replace.



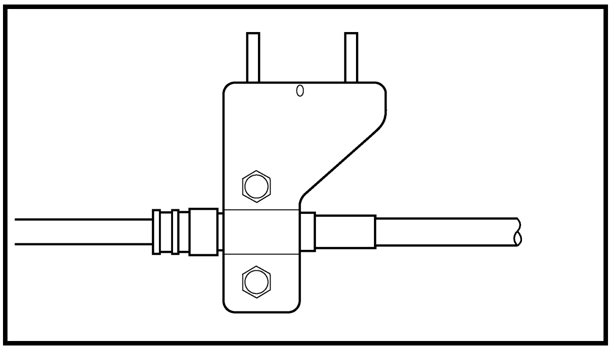

### Steering cable (jet pump end) installation

1. Install:
   - Steering cable

**Steering cable set length ⓐ (jet pump end):**
**14.5 mm (0.57 in)**

**⚠ WARNING**

**The steering cable must be screwed in at least 8 mm (0.31 in).**

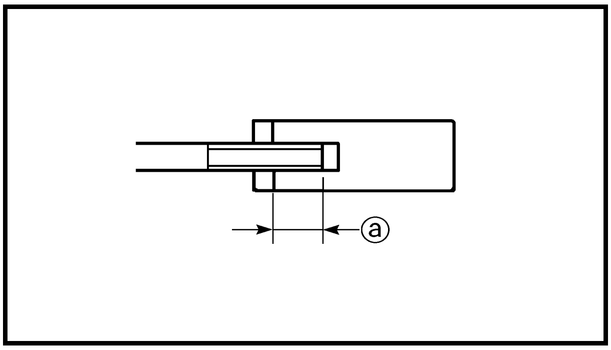


### Steering cable stopper installation

1. Install:
   - Steering cable stopper

**⚠ WARNING**

**Be sure to the steering cable stopper into the groove in the outer cable as shown in the illustration.**



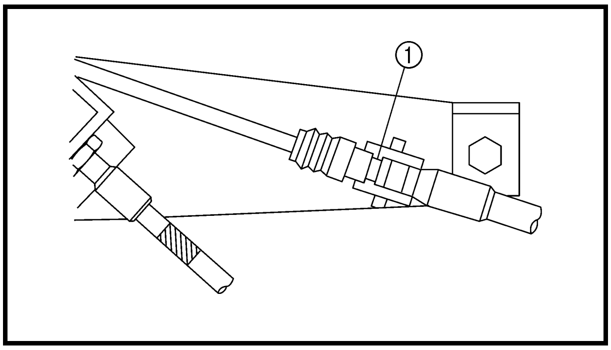

**QSTS cable (jet pump end) installation**

1. Install:
   - QSTS cable (jet pump end)

**QSTS cable set length ⓐ (jet pump end):**
**13.6 mm (0.54 in)**

**⚠ WARNING**

**The QSTS cable must be screwed in more than 8 mm (0.31 in).**

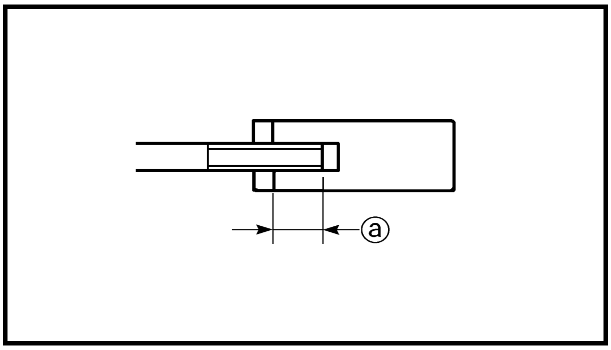



**QSTS cable stopper installation**

1. Install:
   - QSTS cable stopper

**⚠ WARNING**

**Be sure to fit the projection ① on the QSTS cable stopper into the groove in the outer cable.**



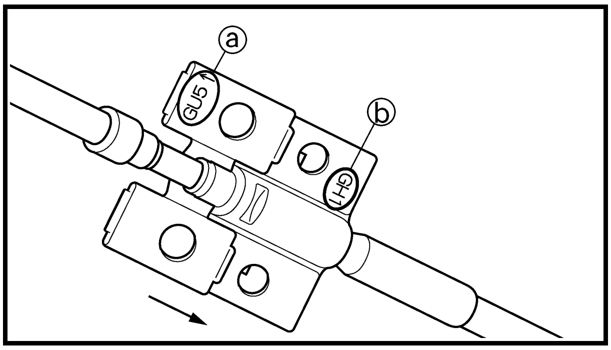

**Shift cable (jet pump end) installation**

1. Install:
   - Shift cable (jet pump end)

**Shift cable set length ⓐ (jet pump end):**
**13.6 mm (0.54 in)**

**⚠ WARNING**

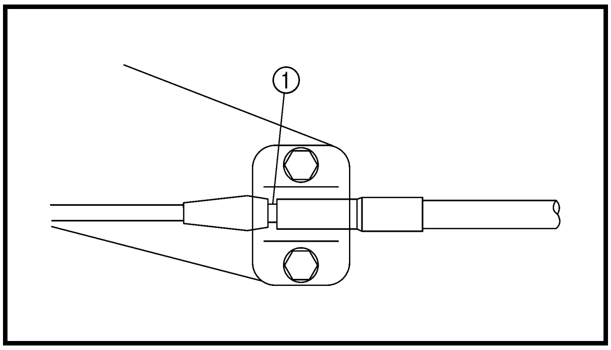
**The shift cable must be screwed in more than 8 mm (0.31 in).**




**Shift cable holder installation**

1. Install:
   - Shift cable holders

**NOTE:**
Install the shift cable holders so that mark ⓐ and mark ⓑ are in the positions shown in the illustration.




**Shift cable stopper installation**

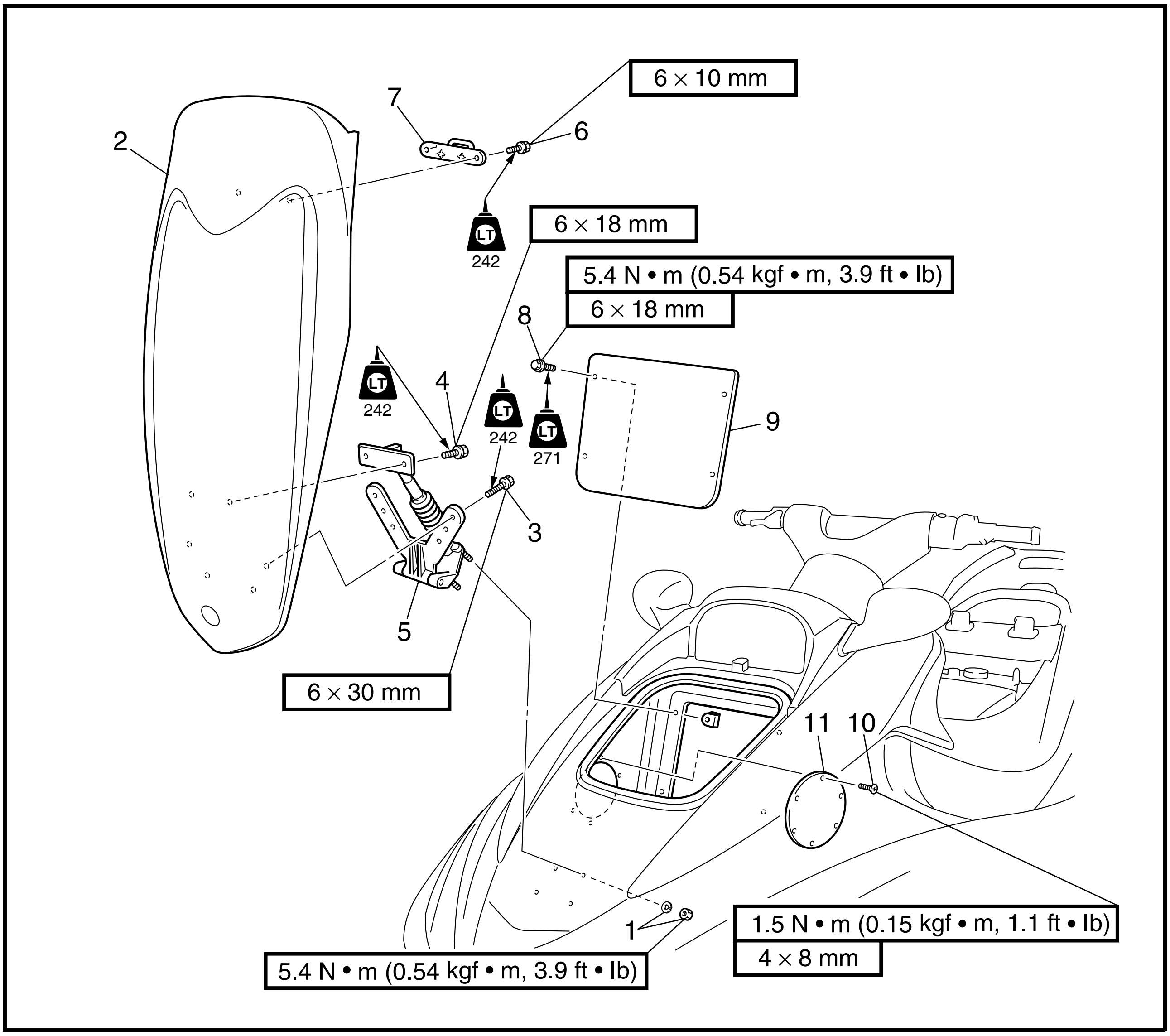
1. Install:
   - Shift cable stopper

**⚠ WARNING**
**Be sure to fit the projection ① on the shift cable stopper into the groove in the outer cable.**

**Remote control cables adjustment**

Refer to "CONTROL SYSTEM" in Chapter 3.

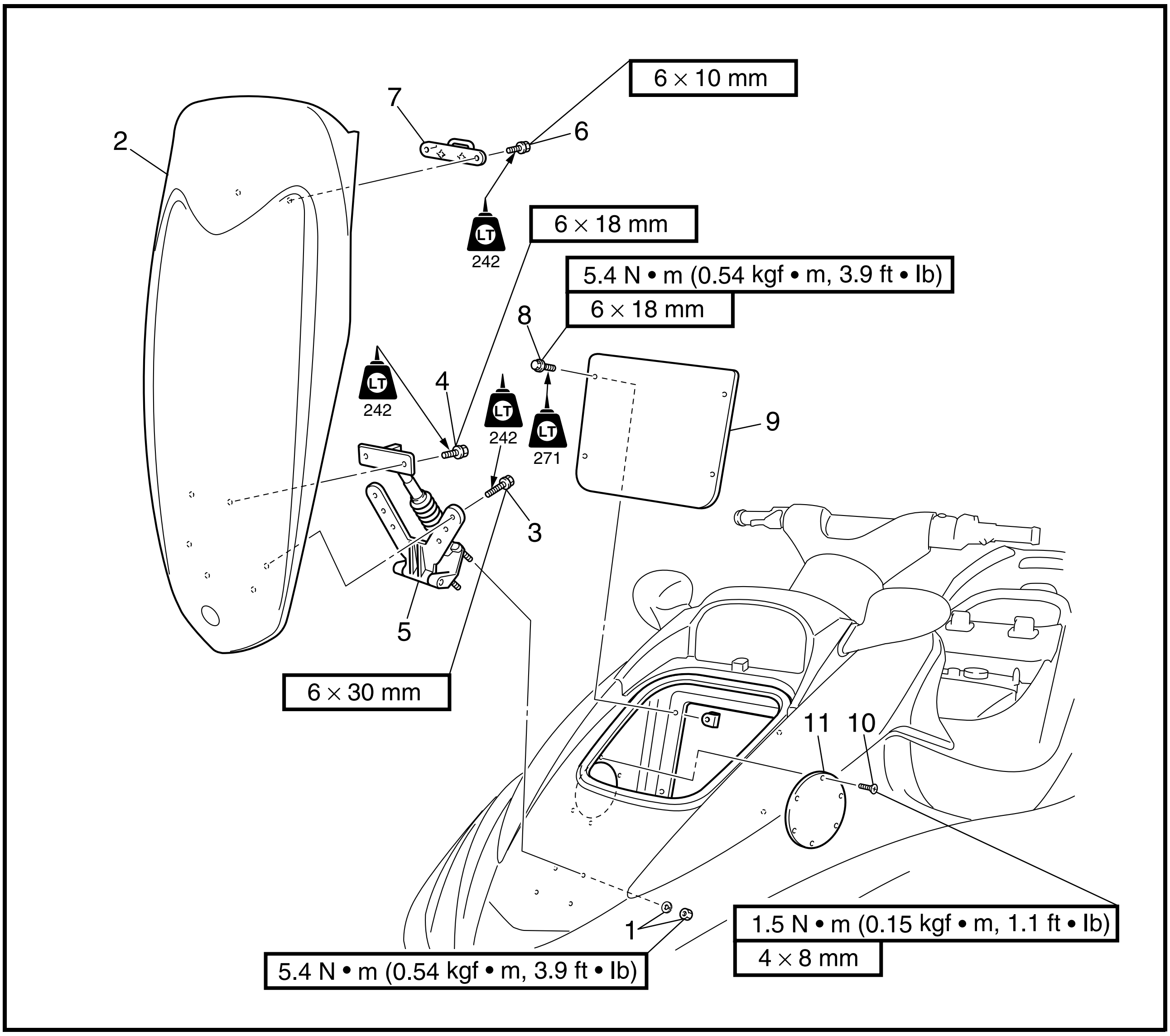
# FRONT HOOD
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

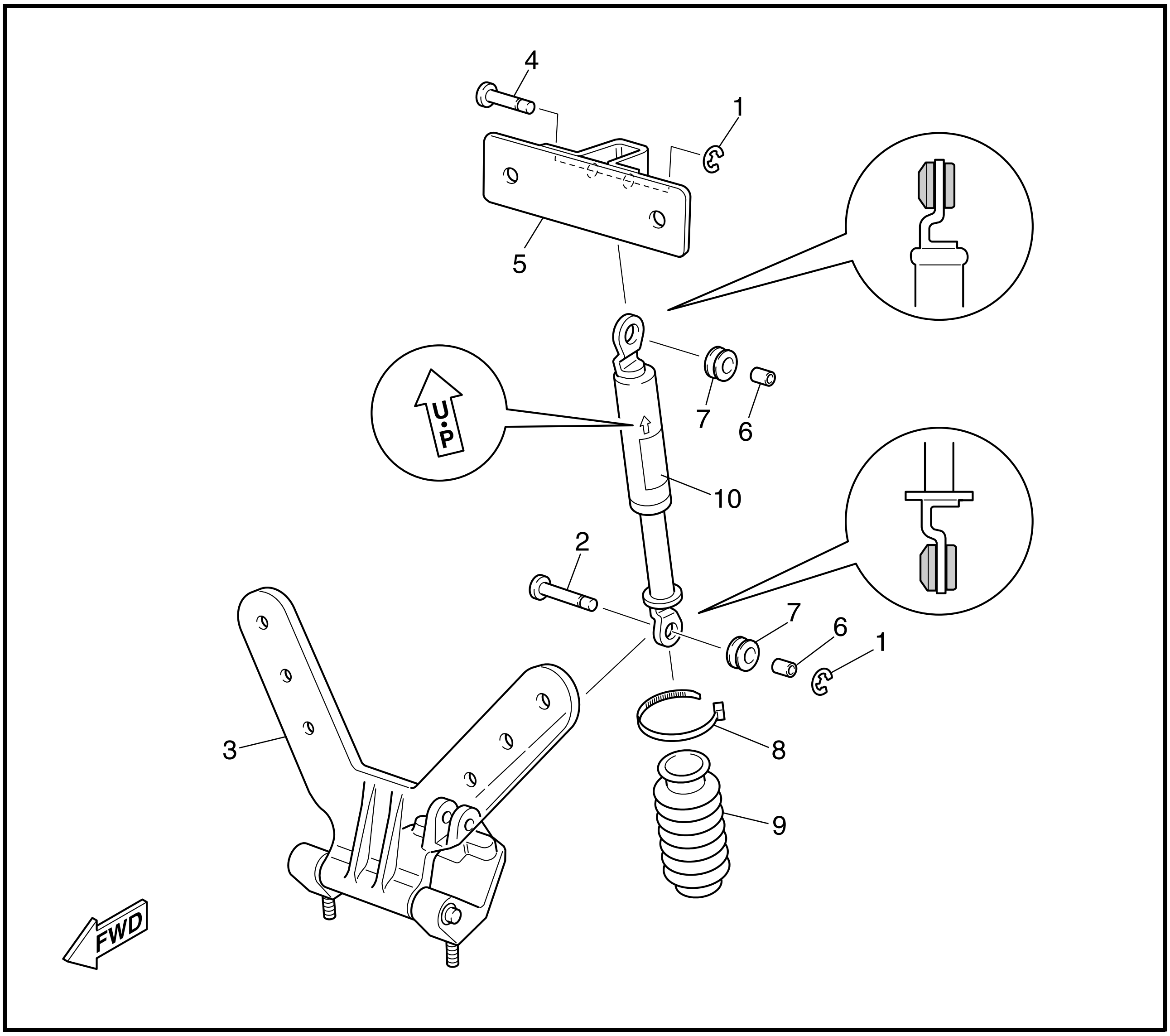
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FRONT HOOD REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Nut/washer | 4/4 | |
| 2 | Front hood assembly | 1 | |
| 3 | Bolt | 4 | |
| 4 | Bolt | 2 | |
| 5 | Hinge assembly | 1 | |
| 6 | Bolt | 2 | |
| 7 | Hood lock assembly | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Bolt | 4 | |
| 9 | Service lid 1 | 1 | |
| 10 | Screw | 4 | |
| 11 | Service lid 2 | 1 | |
| | | | Reverse the removal steps for installation. |

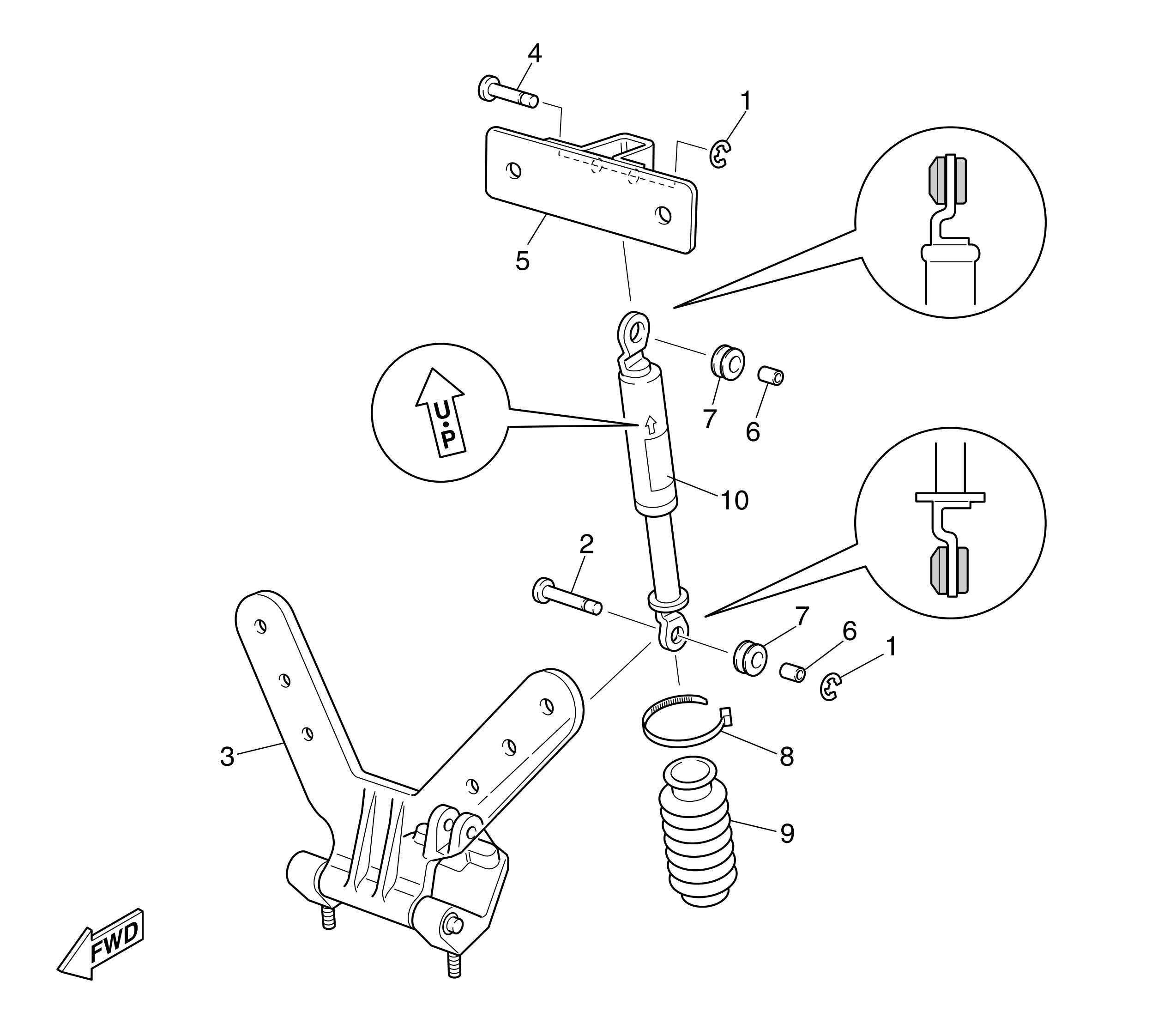
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

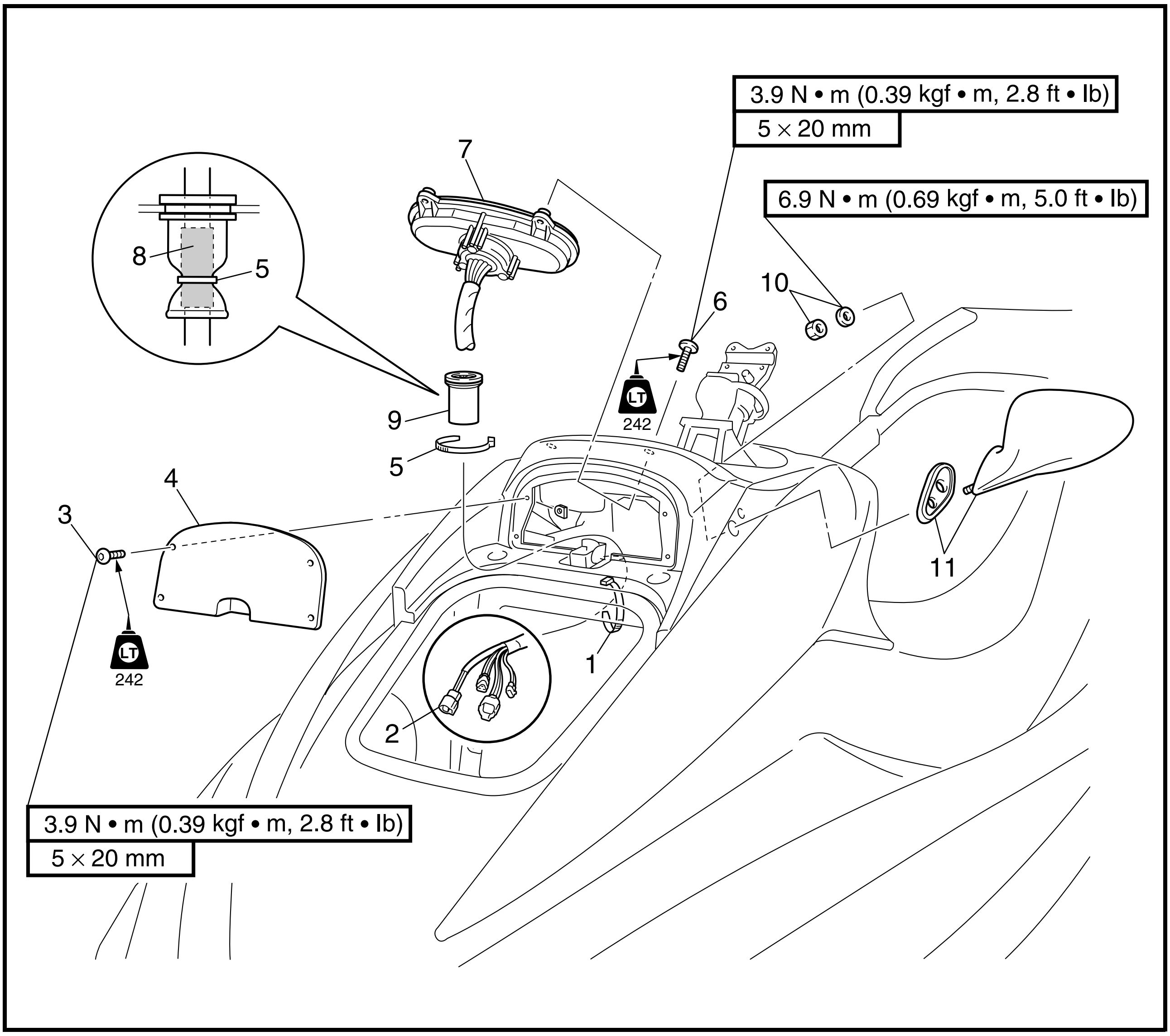
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **HINGE DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Circlip | 2 | |
| 2 | Pin (long) | 1 | |
| 3 | Hinge | 1 | |
| 4 | Pin (short) | 1 | |
| 5 | Damper stay | 1 | |
| 6 | Collar | 2 | |
| 7 | Grommet | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Clamp | 1 | **Not reusable** |
| 9 | Damper boots | 1 | |
| 10 | Damper | 1 | |
| | | | Reverse the disassembly steps for assembly. |

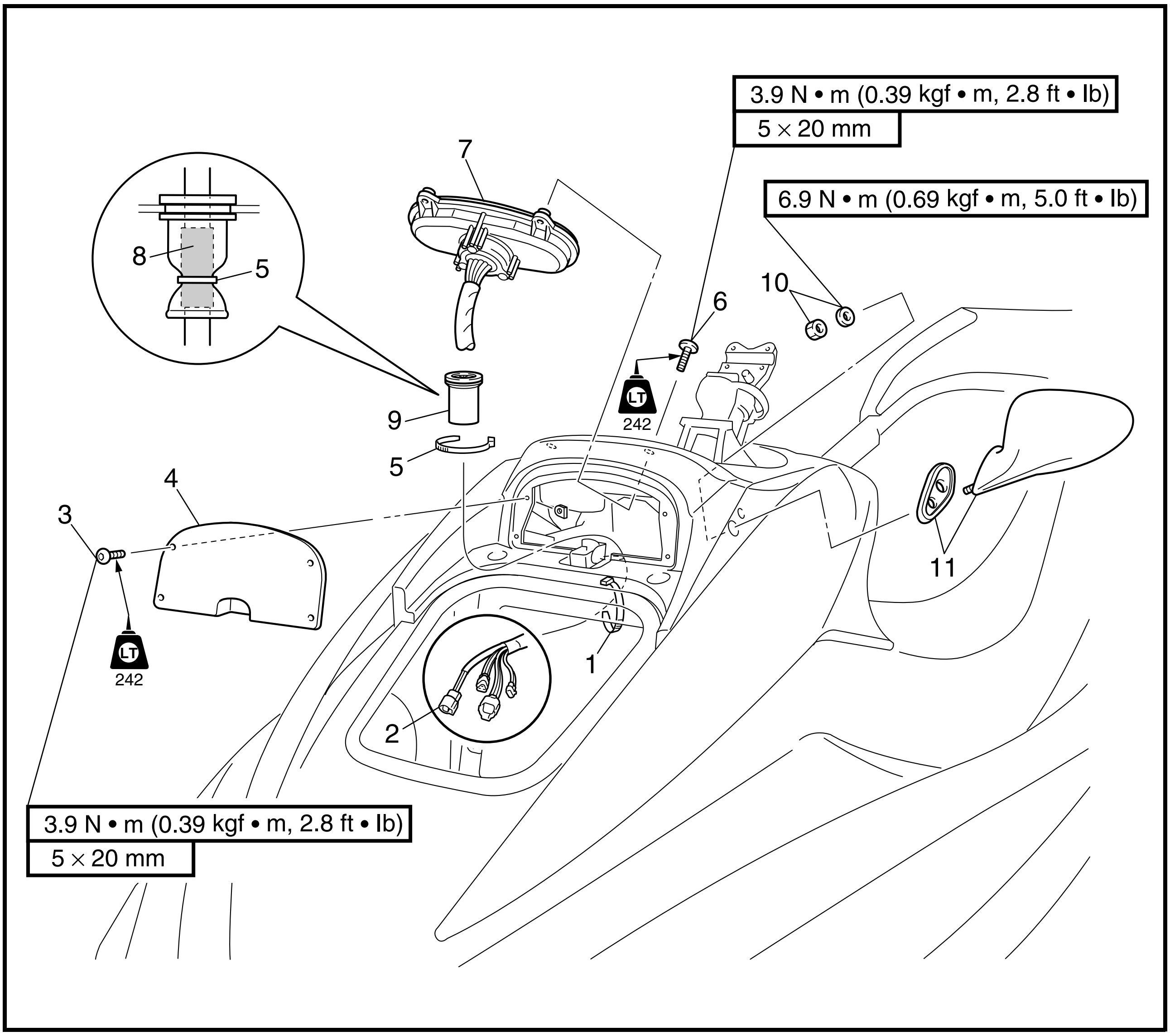
# STEERING CONSOLE COVER
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

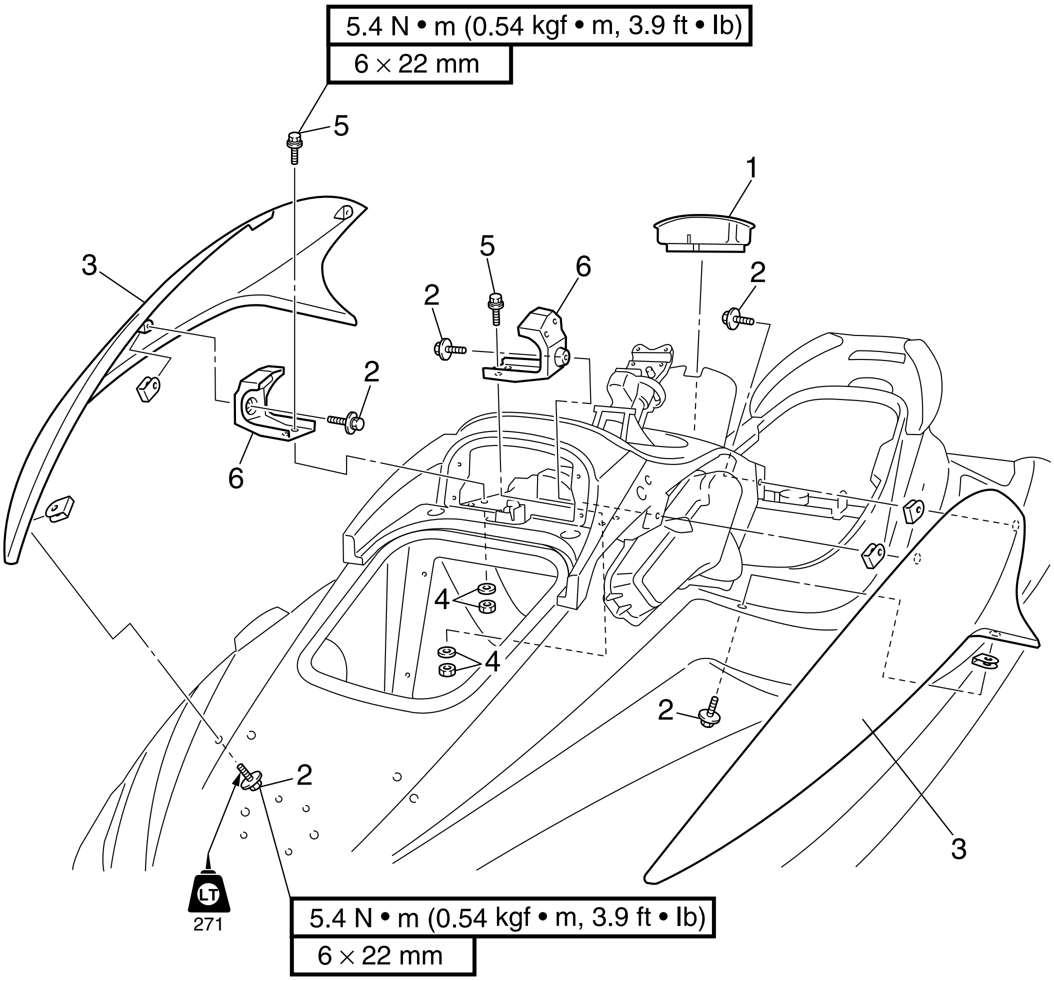
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **METER AND MIRROR REMOVAL** | | Follow the left "Step" for removal. |
| | Handlebar assembly | | Refer to "HANDLEBAR". |
| | Service lid 1 | | Refer to "FRONT HOOD". |
| 1 | Clamp | 1 | |
| 2 | Multifunction meter coupler | 3 | **NOTE:** The handlebar switch coupler and buzzer coupler have been disconnected. |
| 3 | Bolt | 4 | |
| 4 | Panel | 1 | |
| 5 | Band | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Bolt | 4 | |
| 7 | Multifunction meter | 1 | |
| 8 | Hose packing | 1 | **Not reusable** |
| 9 | Grommet | 1 | |
| 10 | Nut/washer | 4/4 | |
| 11 | Mirror | 2 | |
| | | | Reverse the removal steps for installation. |

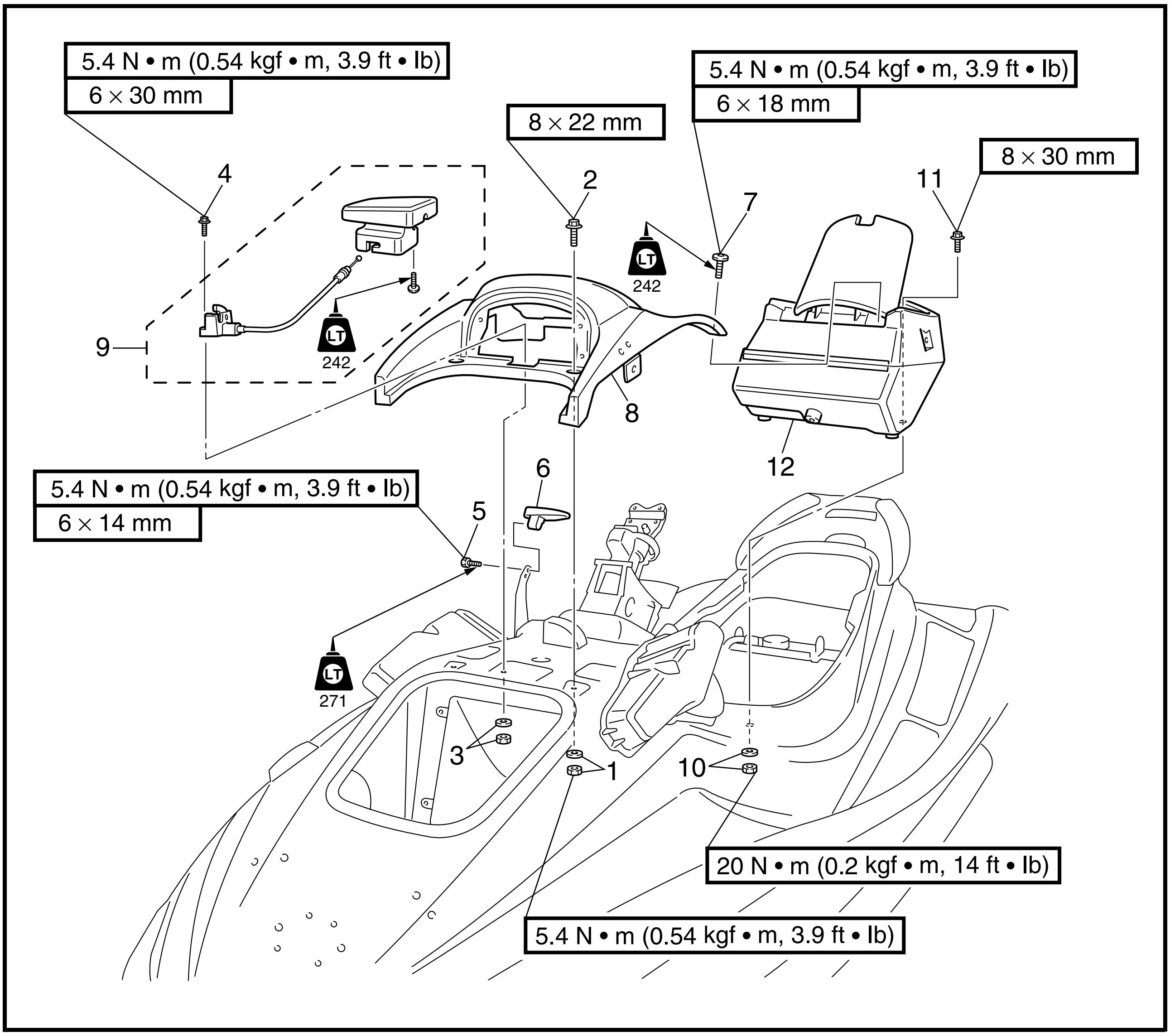
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **SIDE COVER REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Cup holder | 1 | |
| 2 | Bolt | 8 | |
| 3 | Side cover | 2 | |
| 4 | Nut/washer | 4/4 | |
| 5 | Bolt | 4 | |
| 6 | Bracket | 2 | |
| | | | Reverse the removal steps for installation. |

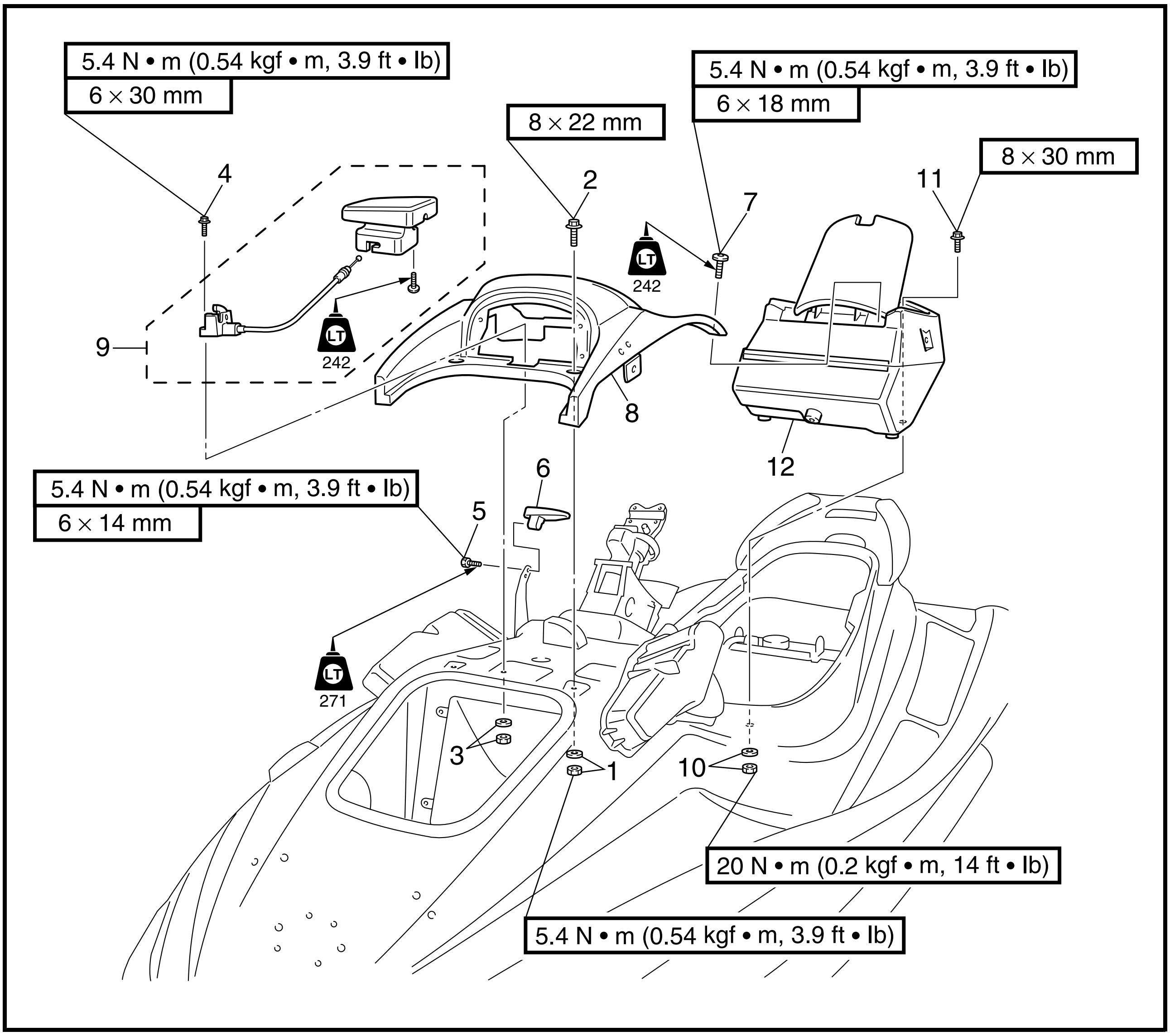
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

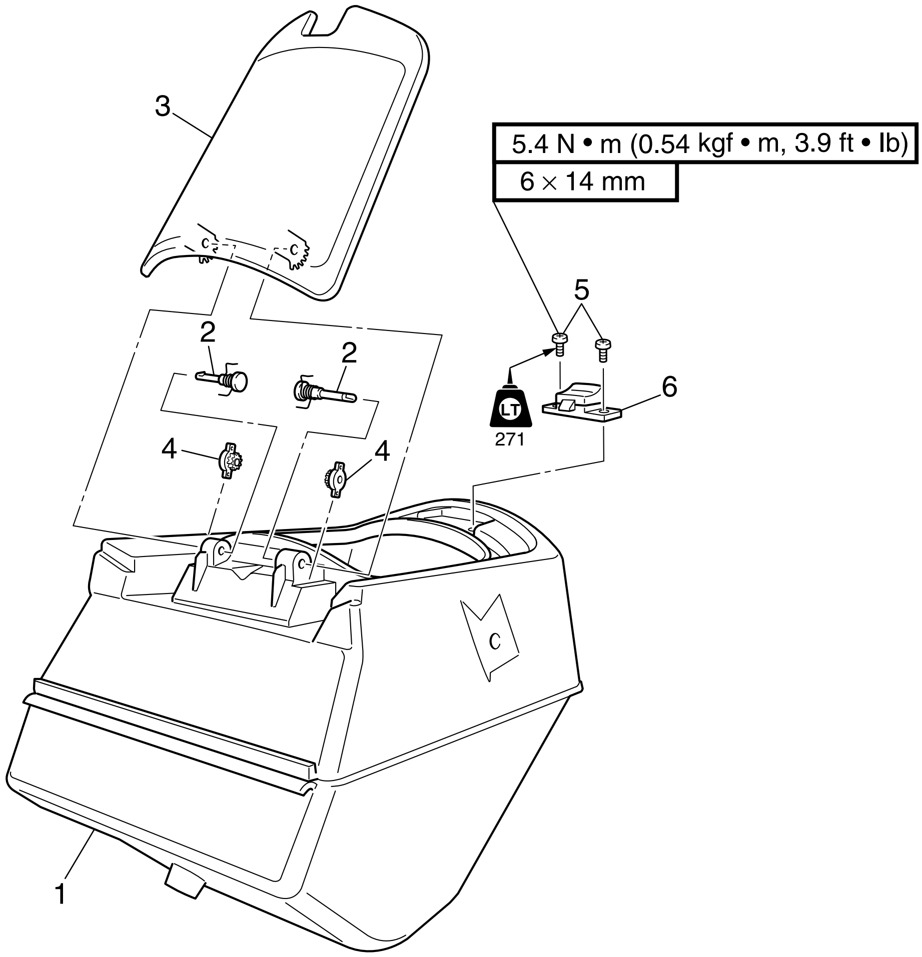
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **STEERING CONSOLE COVER AND GLOVE BOX ASSEMBLY REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Nut/washer | 2/2 | |
| 2 | Bolt | 2 | |
| 3 | Nut/washer | 2/2 | |
| 4 | Bolt | 2 | |
| 5 | Bolt | 2 | |
| 6 | Shift handle lever | 1 | |

## EXPLODED DIAGRAM



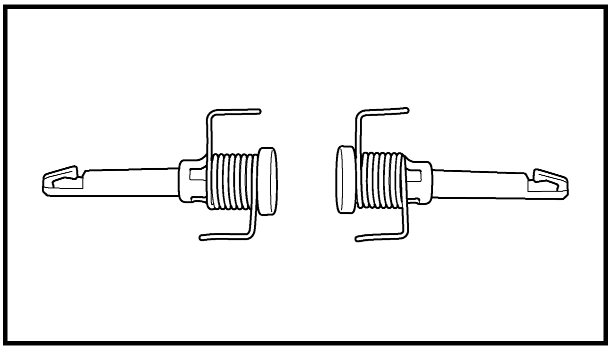

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Bolt | 2 | |
| 8 | Steering console cover | 1 | **NOTE:** To remove the console cover easily, pull the tilt lever up. |
| 9 | Hood lock assembly | 1 | |
| 10 | Nut/washer | 2/2 | |
| 11 | Bolt | 2 | |
| 12 | Glove compartment assembly | 1 | |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **GLOVE COMPARTMENT DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Glove compartment | 1 | |
| 2 | Hinge assembly | 2 | |
| 3 | Lid | 1 | |
| 4 | Gear assembly | 2 | |
| 5 | Screw | 2 | |
| 6 | Latch | 1 | |
| | | | Reverse the disassembly steps for assembly. |



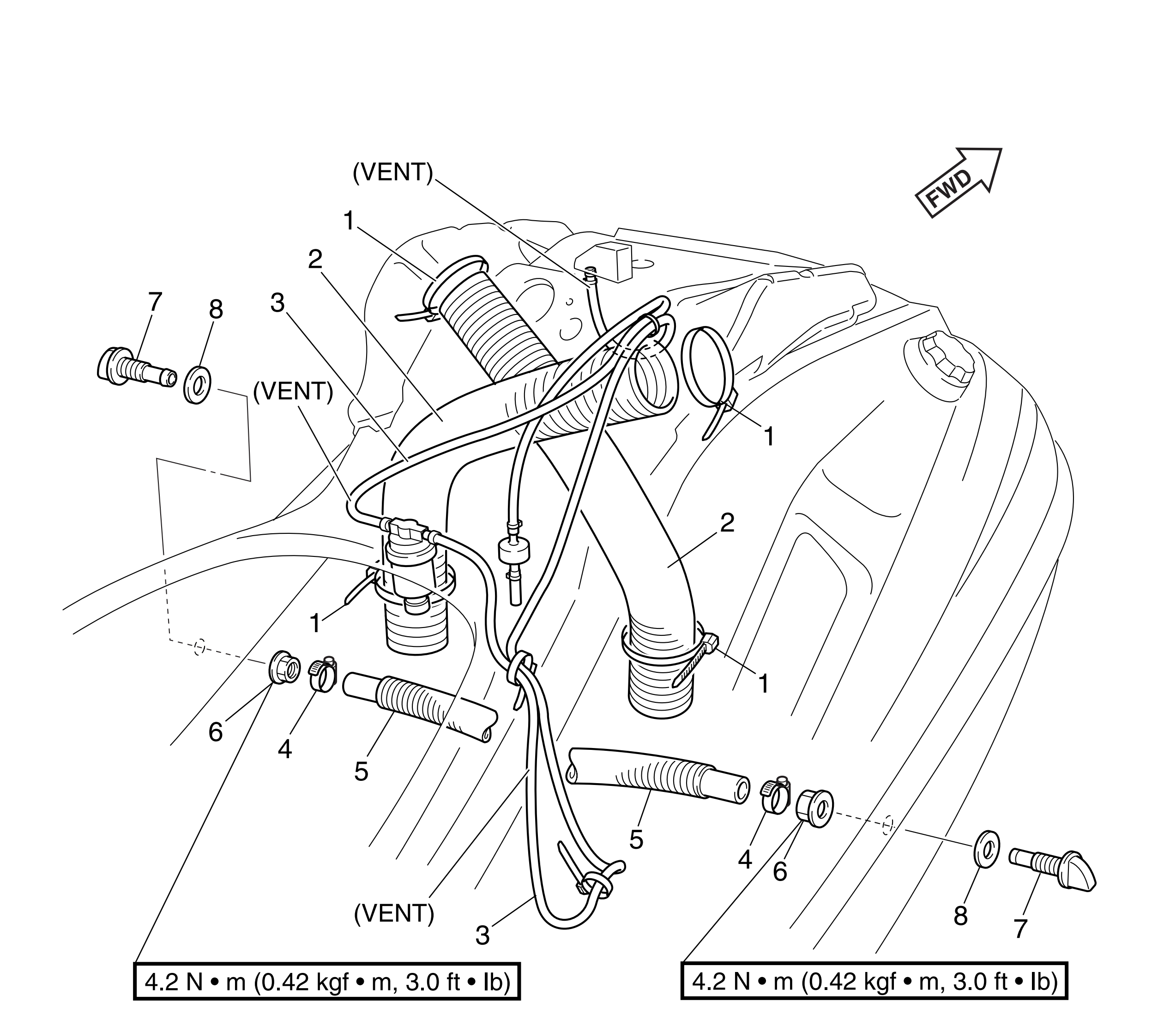
## SERVICE POINTS

### Glove compartment assembly installation

1. Install:
   - Hinge assembly

**NOTE:**
When installing the hinge assembly, make sure that the springs are in the position shown.

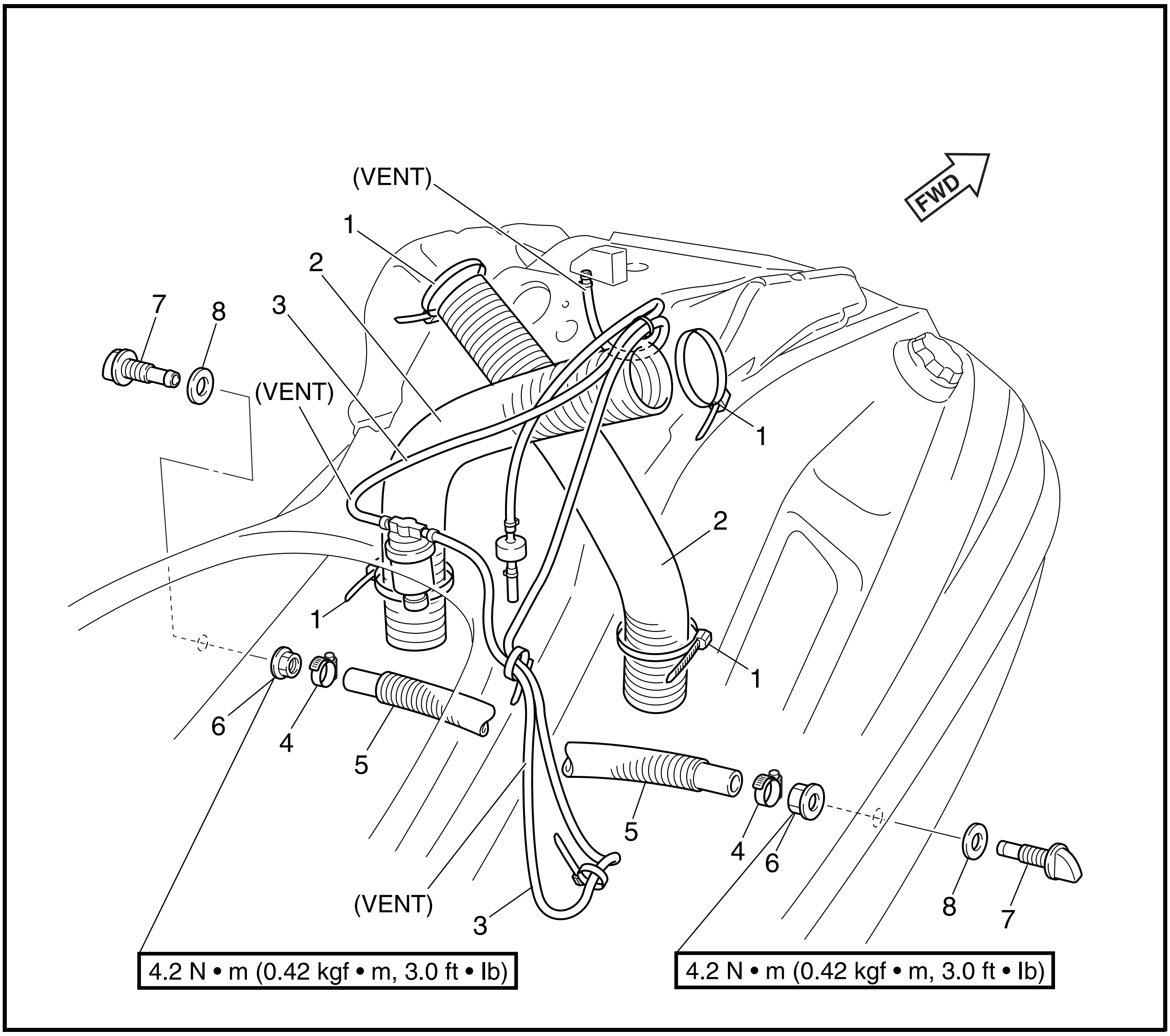
# HOSES
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

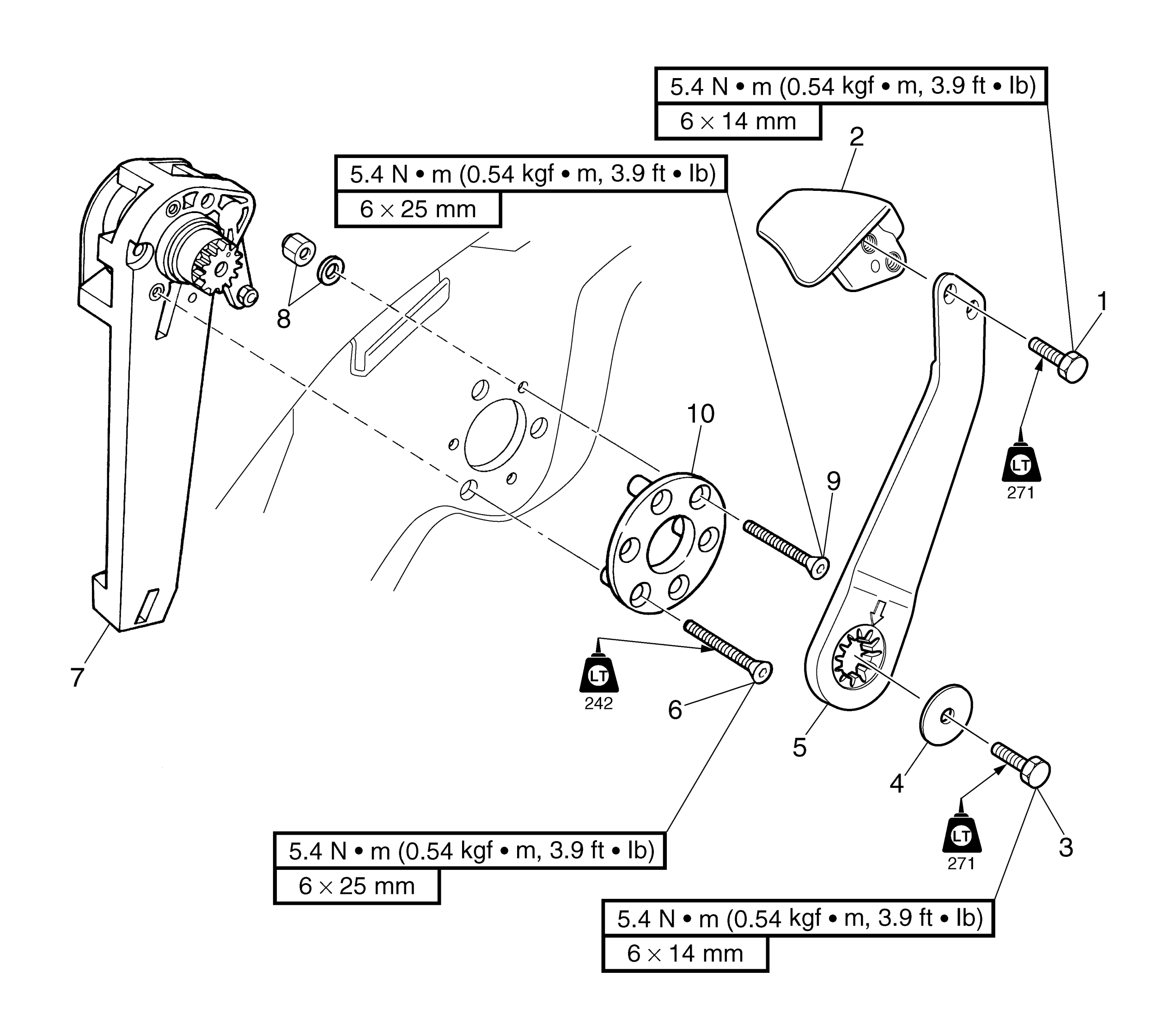
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **HOSES REMOVAL** | | Follow the left "Step" for removal. |
| | Fuel tank | | Refer to "FUEL TANK AND FUEL PUMP MODULE" in Chapter 4.<br>**NOTE:**<br>When removing the ventilation hose and fuel tank breather hose, it is not necessary to remove the fuel tank. |
| 1 | Band | 4 | |
| 2 | Ventilation hose | 2 | |
| 3 | Fuel tank breather hose | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 4 | Clamp | 2 | |
| 5 | Cooling water hose | 2 | |
| 6 | Nut | 2 | |
| 7 | Cooling water pilot outlet | 2 | |
| 8 | Packing | 2 | |
| | | | Reverse the removal steps for installation. |

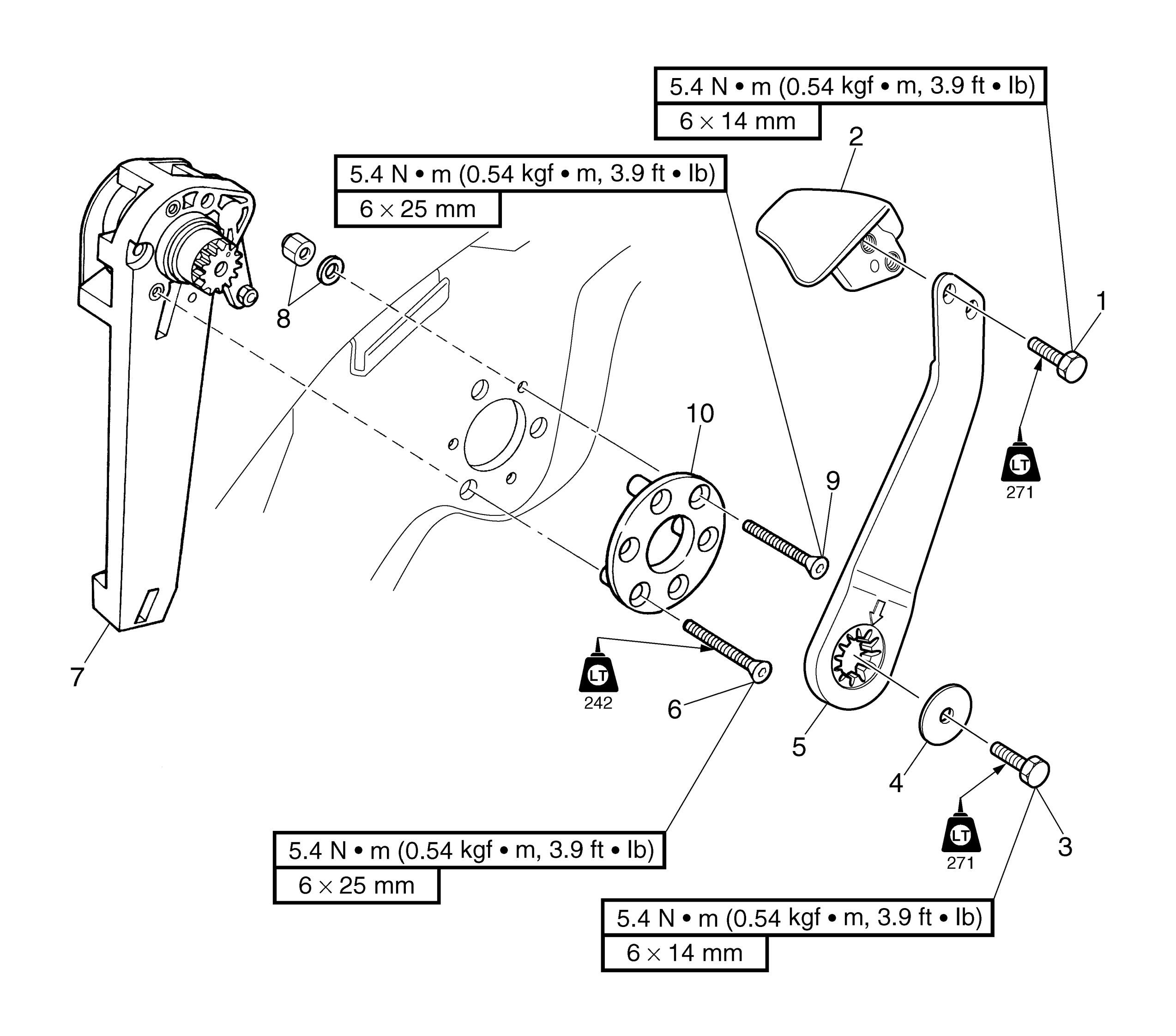
# SHIFT LEVER
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

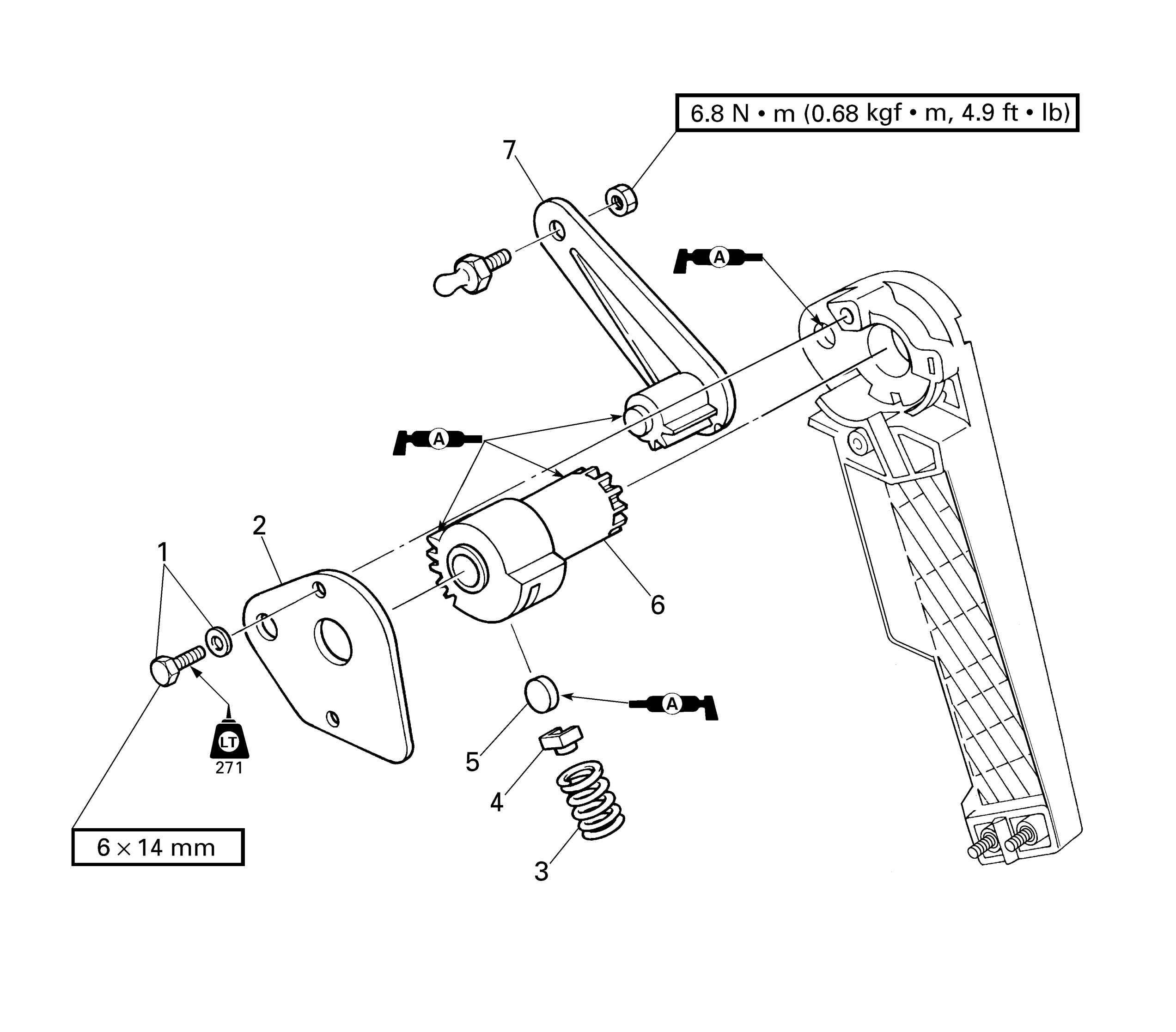
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **SHIFT LEVER REMOVAL** | | Follow the left "Step" for removal. |
| | Side cover | | Refer to "STEERING CONSOLE COVER". |
| | Shift cable | | Refer to "REMOTE CONTROL CABLES AND SPEED SENSOR LEAD". |
| 1 | Bolt | 2 | |
| 2 | Shift lever handle | 1 | |
| 3 | Bolt | 1 | |
| 4 | Washer | 1 | |
| 5 | Shift lever | 1 | |

## EXPLODED DIAGRAM



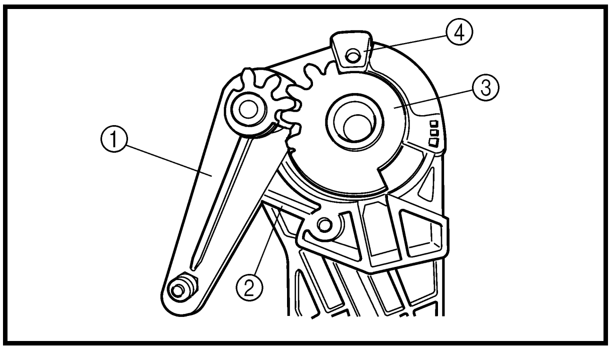

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Screw | 3 | |
| 7 | Base assembly | 1 | |
| 8 | Nut/washer | 3/3 | |
| 9 | Screw | 3 | |
| 10 | Plate | 1 | |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **BASE DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt/washer | 2/2 | |
| 2 | Plate | 1 | |
| 3 | Spring | 1 | |
| 4 | Actuator | 1 | |
| 5 | Roller | 1 | |
| 6 | Shaft | 1 | |
| 7 | Shift arm | 1 | |
| | | | Reverse the disassembly steps for assembly. |

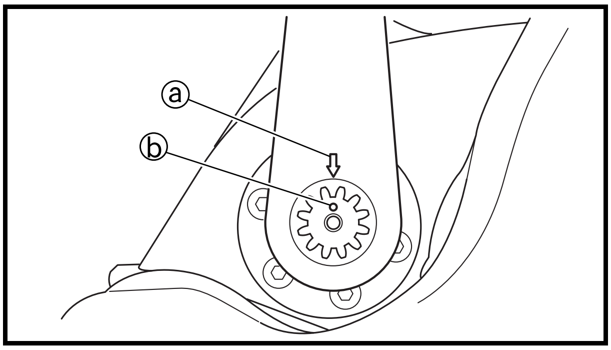



## SERVICE POINTS

### Base assembly

1. Install:
   - Shift arm
   - Shaft

**Installation steps:**
- Install the shift arm ① so that it comes in contact with the stopper ② as shown.
- Install the shaft ③ to the base so that it come in contact with the stopper ④ as shown.

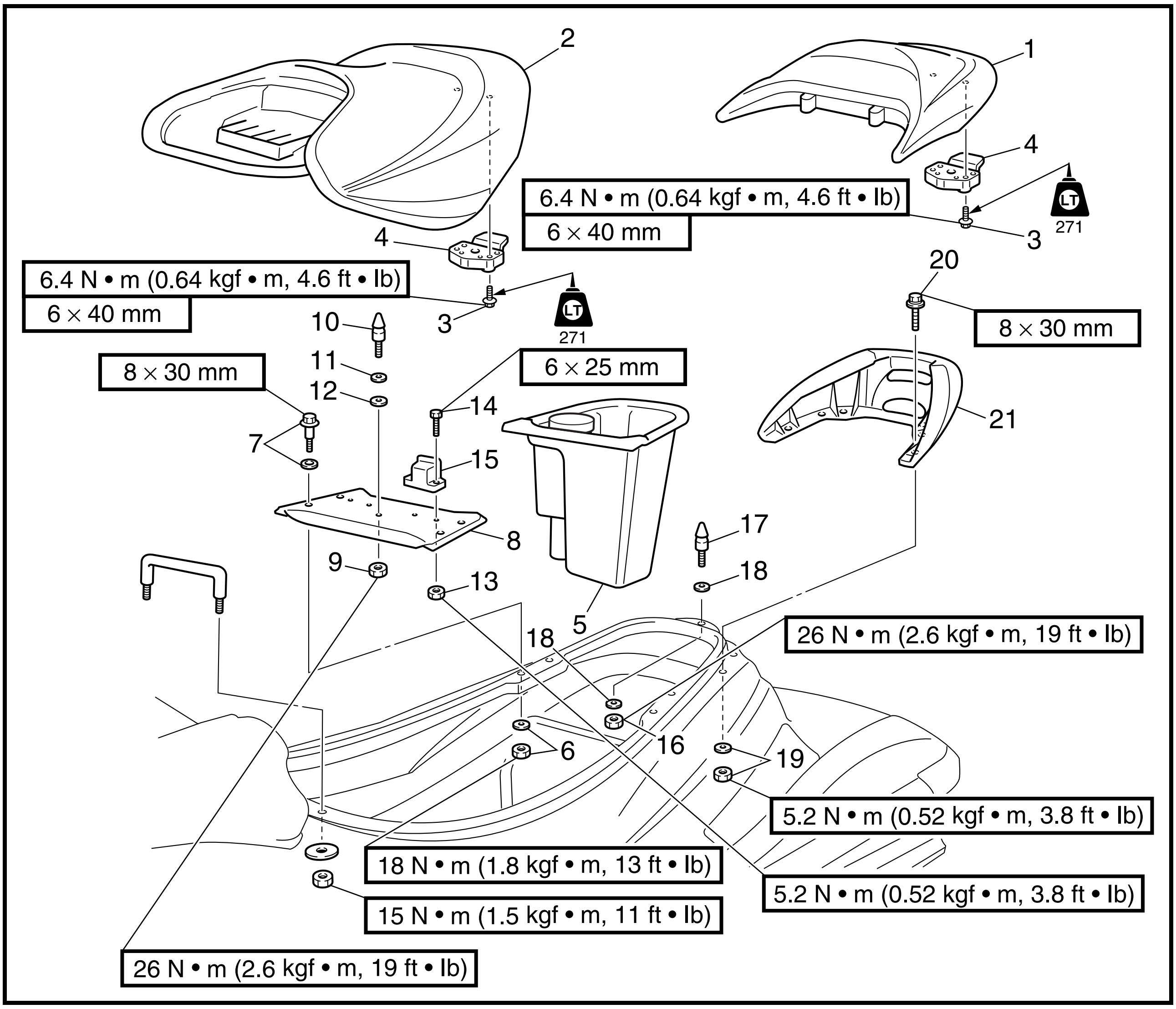



### Shift lever

1. Install:
   - Shift lever

**NOTE:**
To install the shift lever, align the arrow mark ⓐ on the shift lever with the punch mark ⓑ on base assembly.

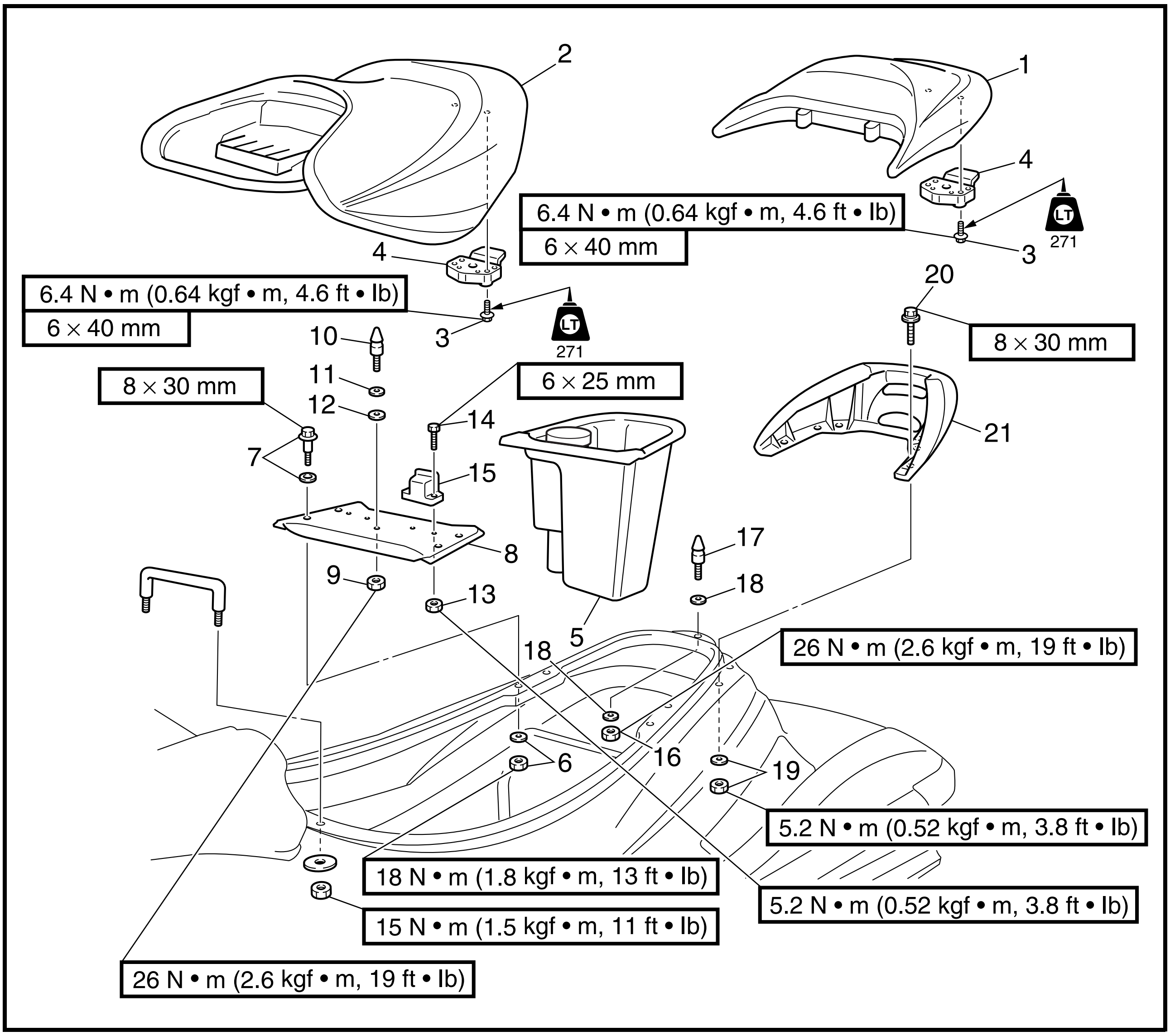
# SEATS AND HAND GRIP
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

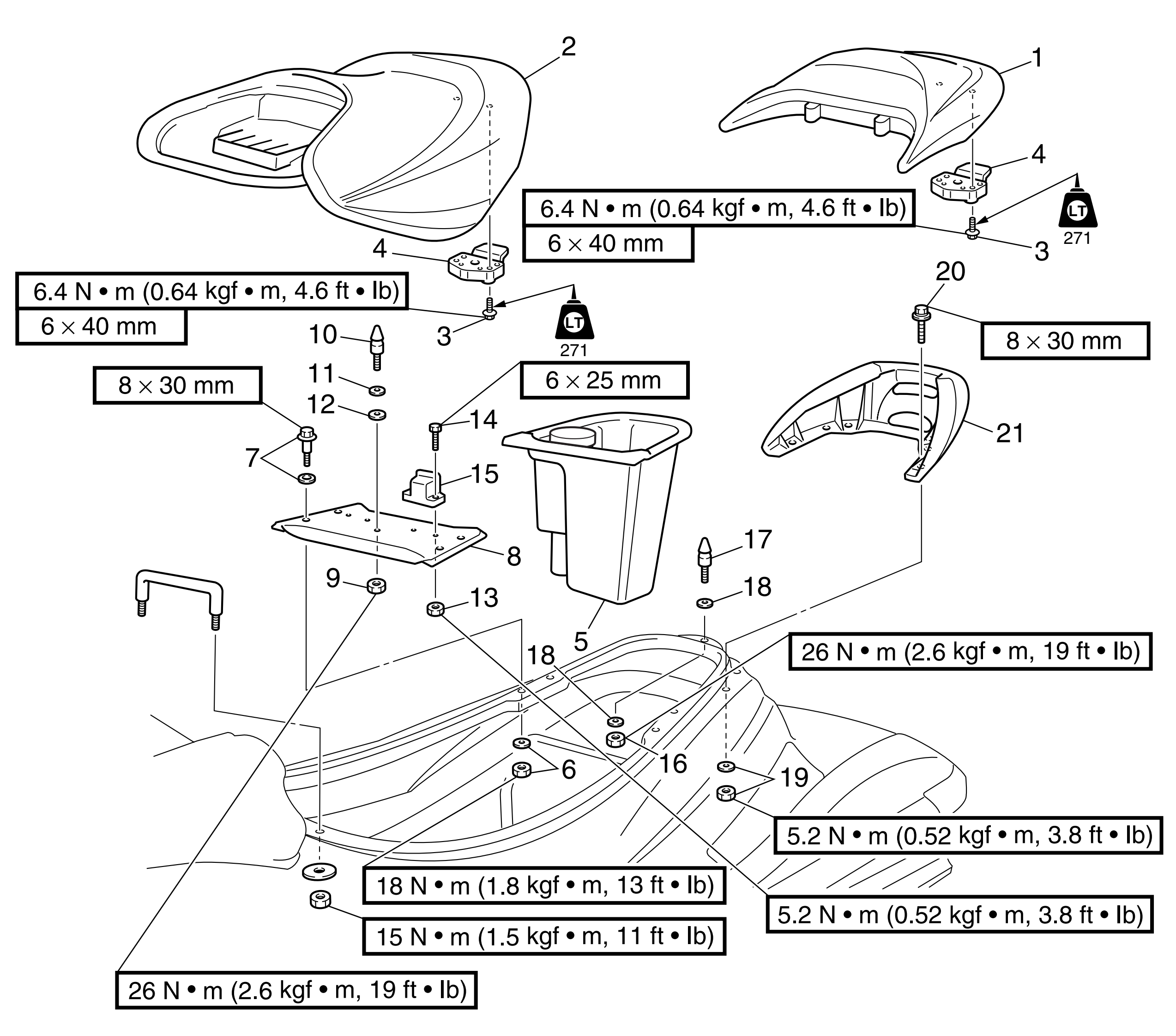
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **SEATS AND HAND GRIP REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Rear seat assembly | 1 | |
| 2 | Front seat assembly | 1 | |
| 3 | Bolt | 4 | |
| 4 | Seat lock assembly | 2 | |
| 5 | Seat storage compartment | 1 | |
| 6 | Nut/washer | 4/4 | |
| 7 | Bolt/washer | 4/4 | |
| 8 | Deck beam | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Nut | 1 | |
| 10 | Projection | 1 | |
| 11 | Washer | 1 | |
| 12 | Packing | 1 | |
| 13 | Nut | 4 | |
| 14 | Bolt | 4 | |
| 15 | Rear seat stay | 2 | |
| 16 | Nut | 1 | |

## EXPLODED DIAGRAM



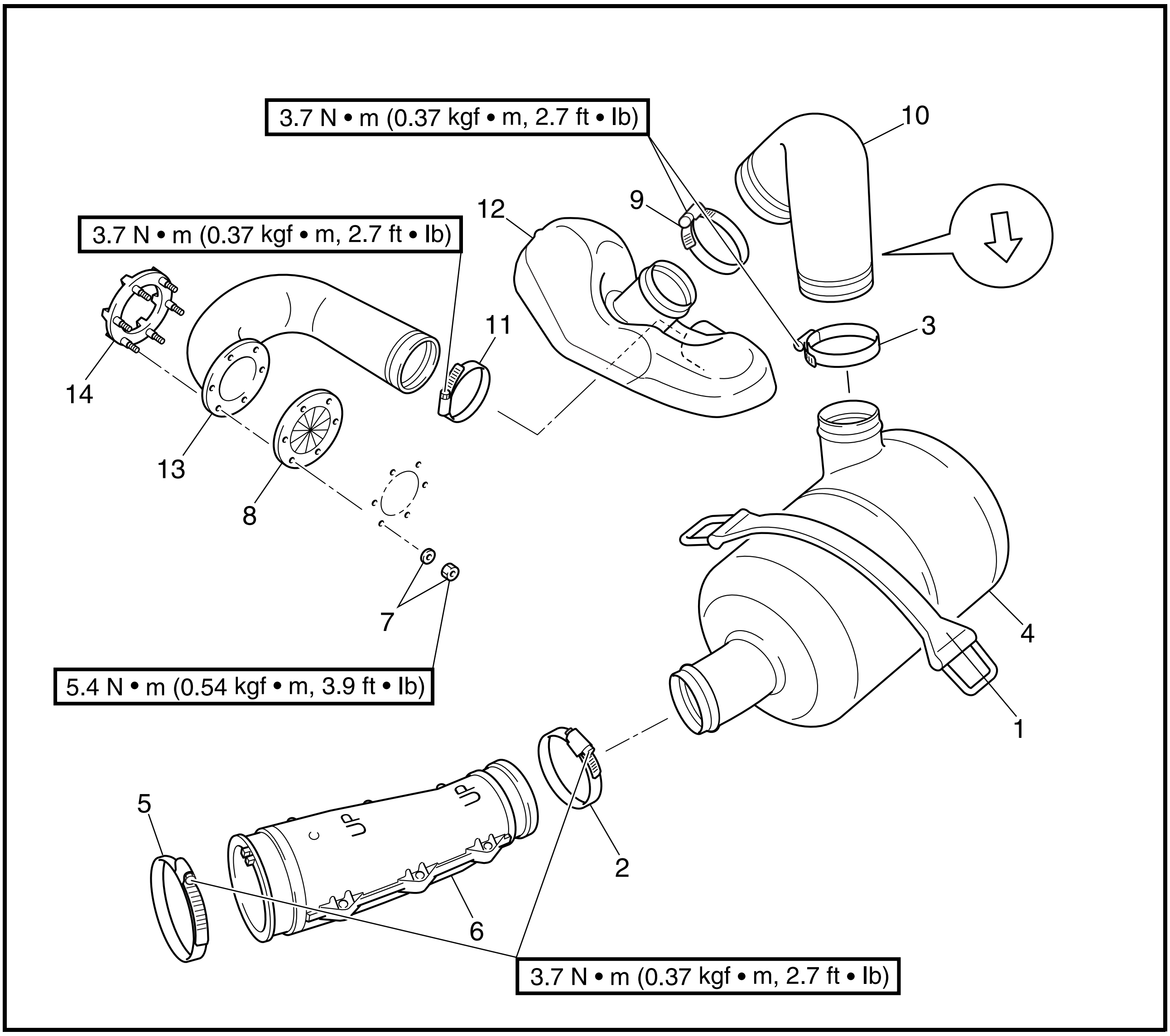

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 17 | Projection | 1 | |
| 18 | Washer | 2 | |
| 19 | Nut/washer | 4/4 | |
| 20 | Bolt | 4 | |
| 21 | Hand grip | 1 | |
| | | | Reverse the removal steps for installation. |

## SERVICE POINTS

### Seat lock inspection

1. Inspect:
   - Front seat lock
   - Rear seat lock
     Damage/wear → Replace.

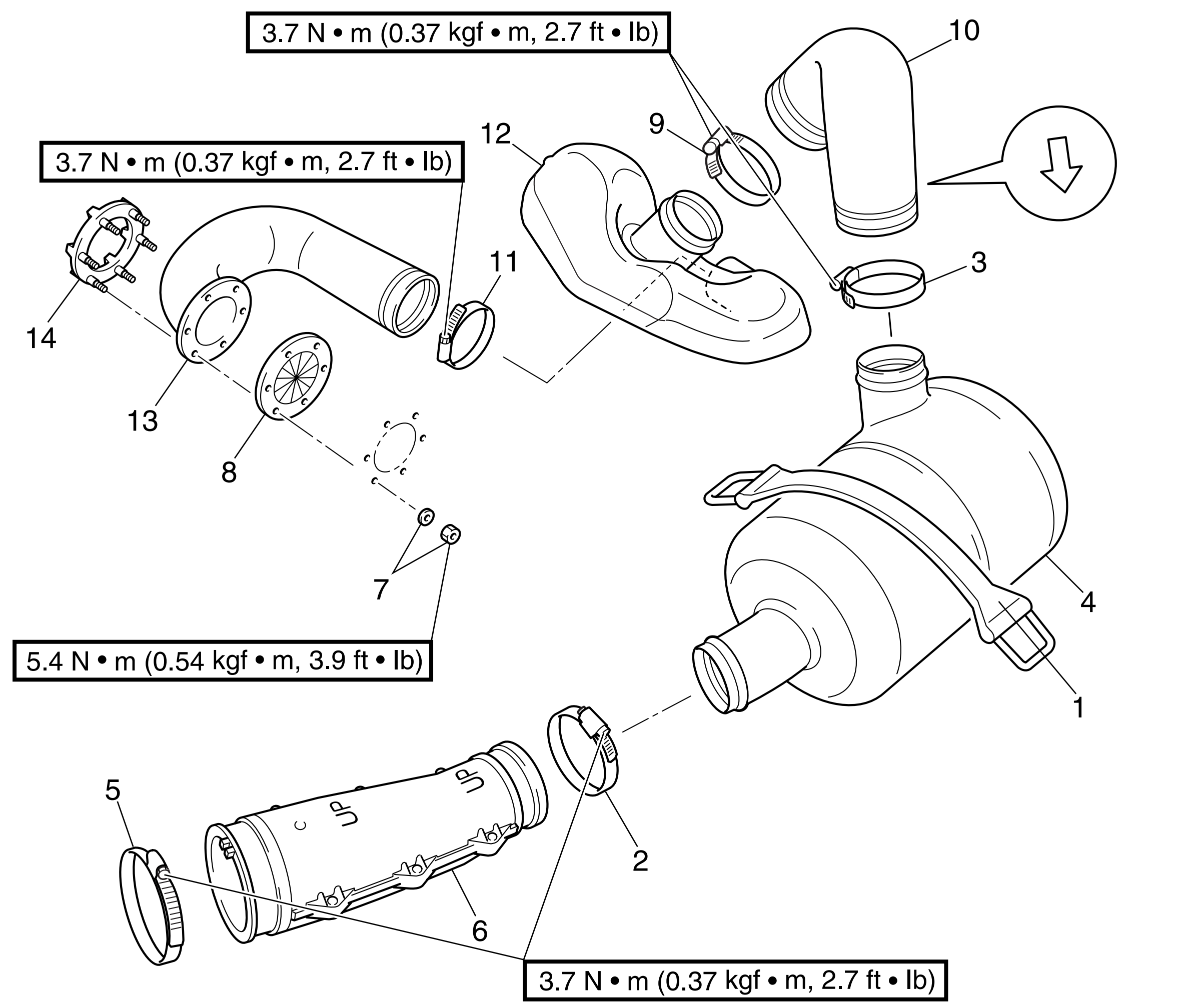
# EXHAUST SYSTEM
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

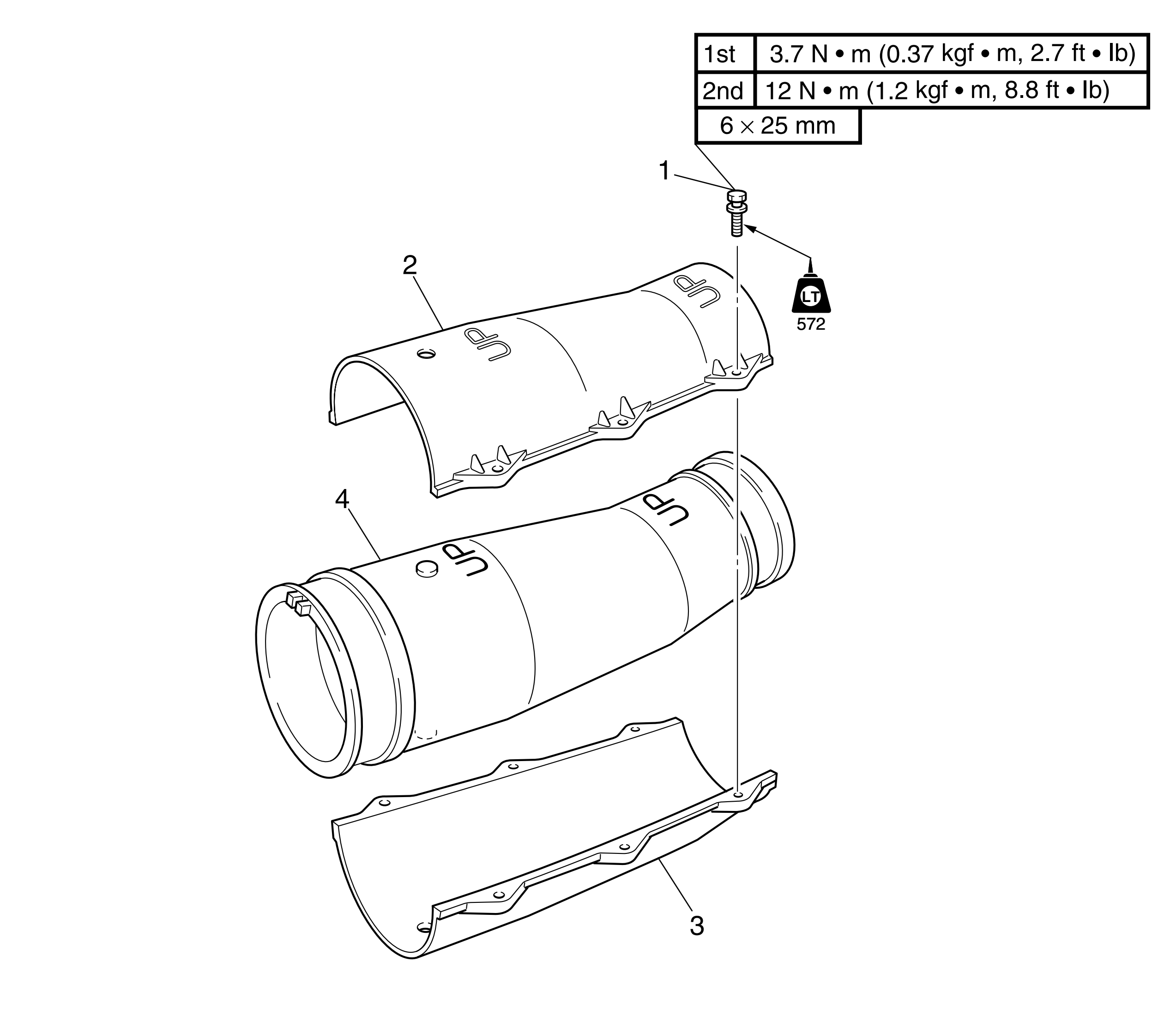
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **EXHAUST SYSTEM REMOVAL** | | Follow the left "Step" for removal. |
| | Deck beam | | Refer to "SEATS AND HAND GRIP". |
| | Jet pump unit assembly | | Refer to "JET PUMP UNIT" in Chapter 6.<br>**NOTE:**<br>When removing the water lock and exhaust joint, it is not necessary to remove the jet pump unit. |
| 1 | Band | 1 | |
| 2 | Exhaust joint clamp | 1 | |
| 3 | Hose clamp | 1 | |
| 4 | Water lock | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 5 | Exhaust joint clamp | 1 | |
| 6 | Exhaust joint | 1 | |
| 7 | Nut/washer | 6/6 | |
| 8 | Exhaust valve | 1 | **NOTE:** Remove parts 8 to 14 as a set. |
| 9 | Hose clamp | 1 | |
| 10 | Rubber hose | 1 | |
| 11 | Hose clamp | 1 | |
| 12 | Water tank | 1 | |
| 13 | Rubber hose | 1 | |
| 14 | Plate | 1 | |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM



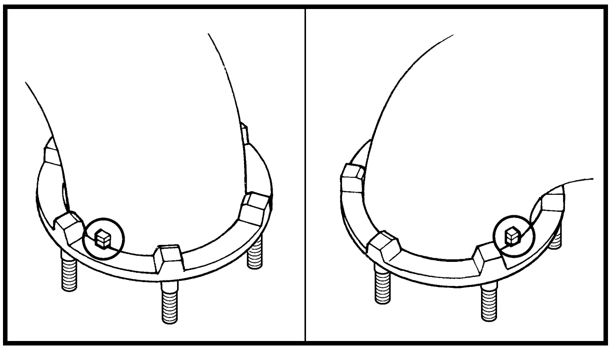

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **EXHAUST JOINT DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt | 6 | |
| 2 | Exhaust joint protector 1 | 1 | |
| 3 | Exhaust joint protector 2 | 1 | |
| 4 | Exhaust joint pipe | 1 | |
| | | | Reverse the disassembly steps for assembly. |

## SERVICE POINTS

### Exhaust system inspection

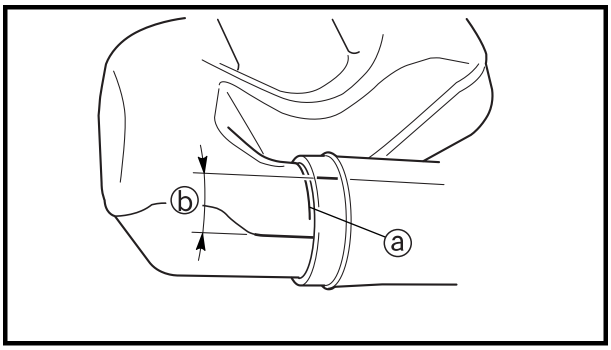
1. Inspect:
   - Water lock band
     Cracks/damage → Replace.
2. Inspect:
   - Rubber hoses
     Burns/cracks/damage → Replace.
3. Inspect:
   - Water lock
     Cracks/leaks → Replace.
4. Inspect:
   - Water tank
     Cracks/damage/leaks → Replace.

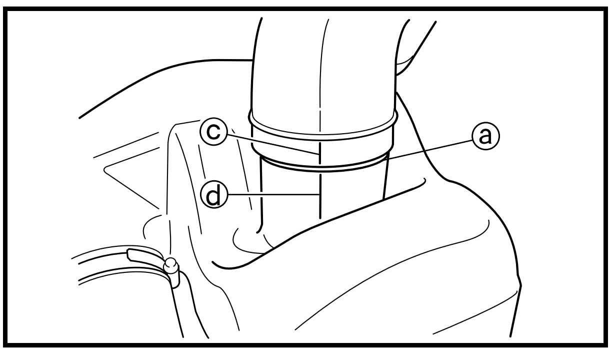


### Exhaust component parts sub-assembly

1. Install:
   - Rubber hose
   - Plate

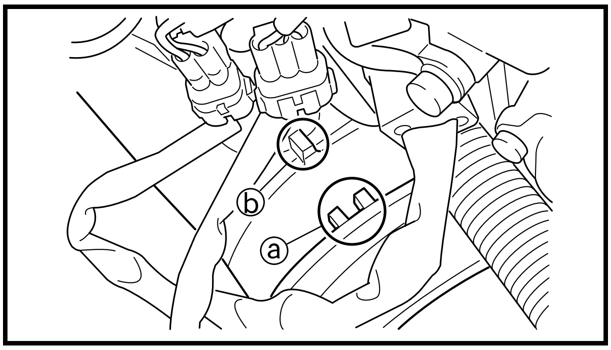
**NOTE:**
Be sure to fit the projections on the rubber hose with the grooves in the plate.




2. Install:
   - Rubber hoses
   - Water tank

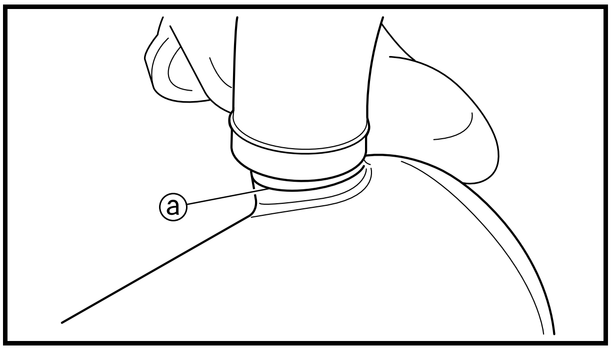
**NOTE:**
- Be sure to insert the rubber hose to the line ⓐ on the water tank.
- Make sure that there is a surface distance of 47 mm (1.9 in) ⓑ between the parting lines of the water tank and rubber hose.
- Align the parting line ⓒ of the rubber hose with the parting line ⓓ of the water tank.




## Exhaust system installation

1. Install:
   - Exhaust joint

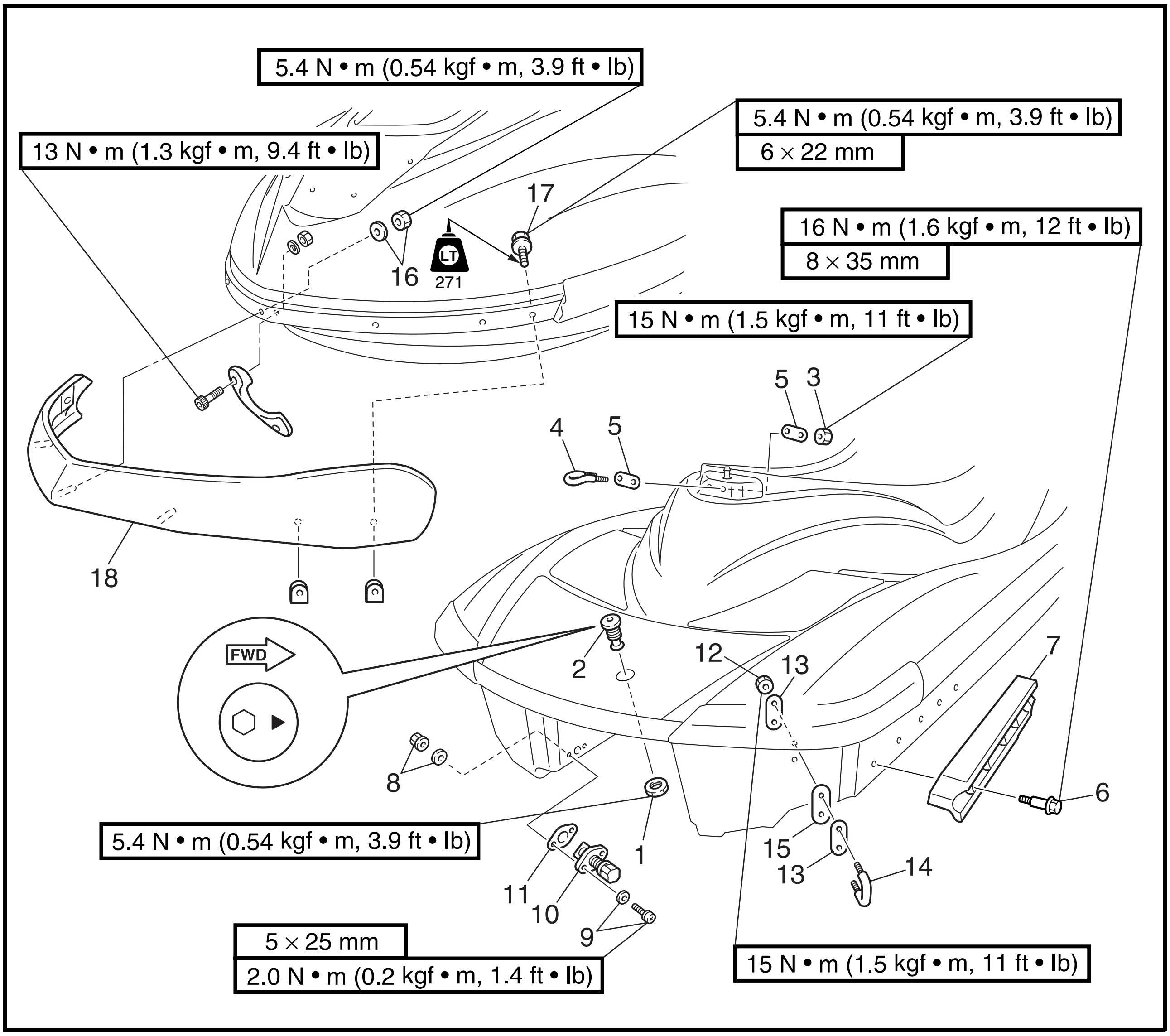
**NOTE:**
Be sure to fit the slit ⓐ on the exhaust joint with the projection ⓑ on the exhaust pipe.




2. Install:
   - Water lock

**NOTE:**
Be sure to insert the rubber hose to the line ⓐ on the water lock.

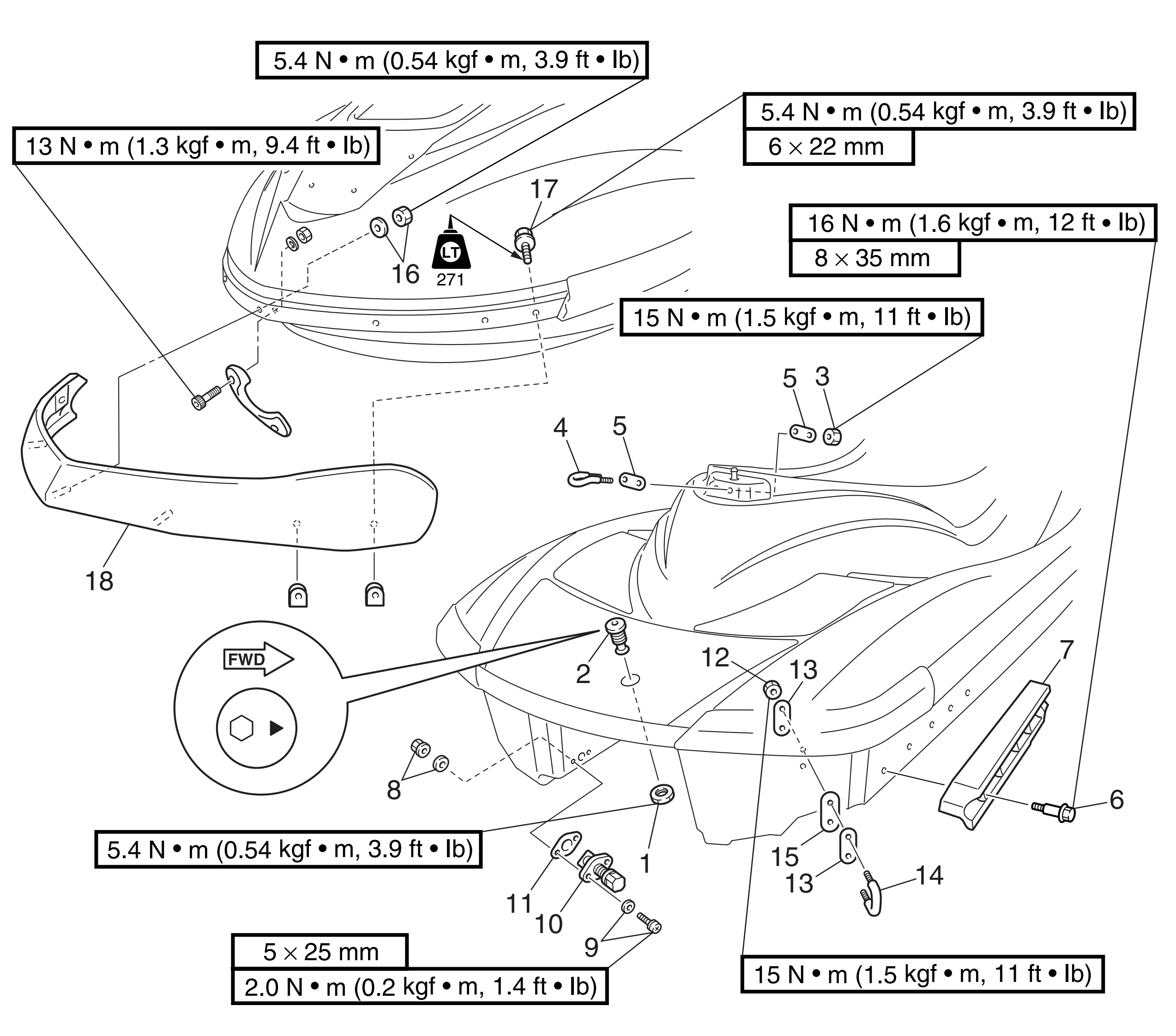
# DECK AND HULL
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

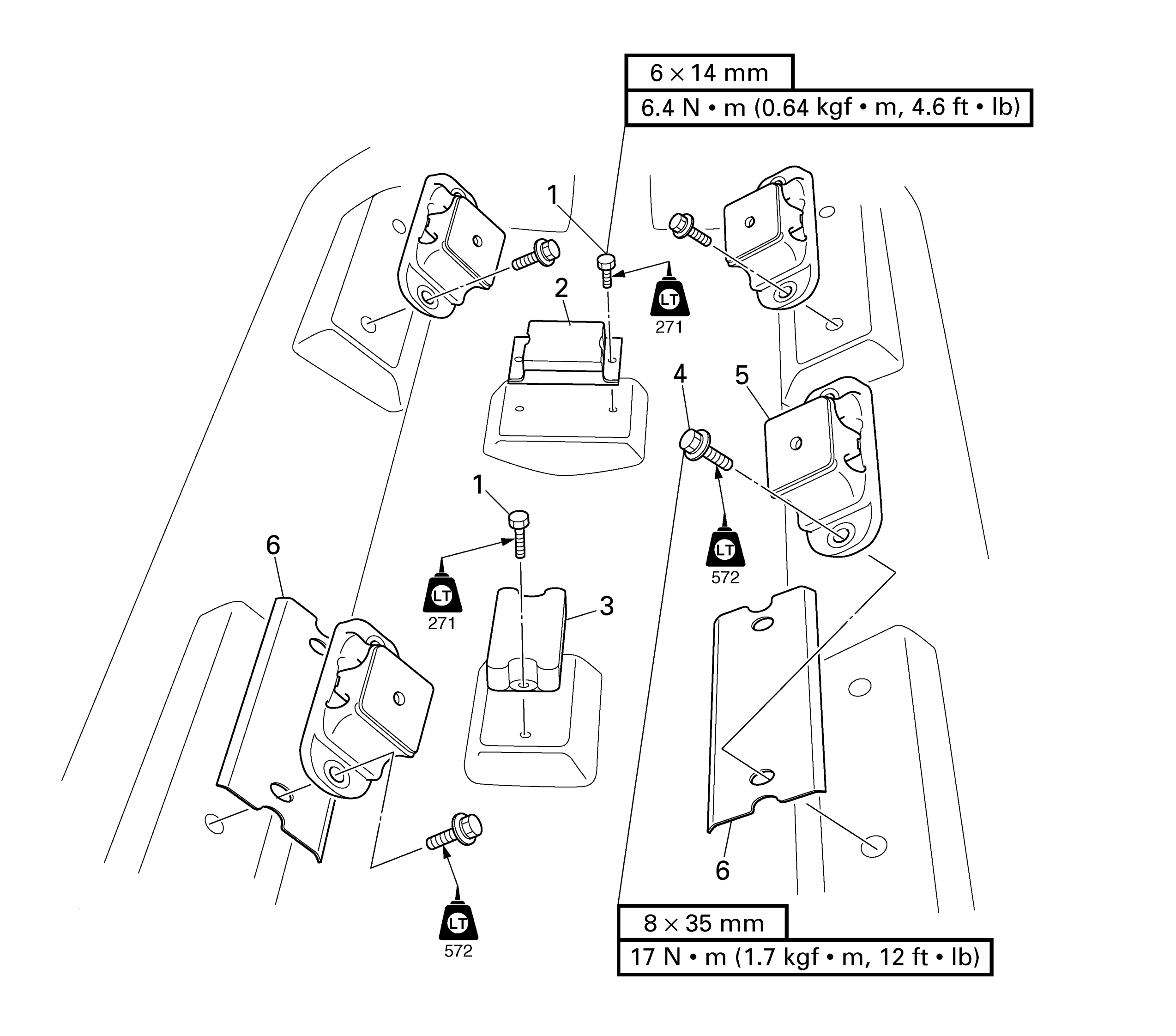
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **DECK AND HULL DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Nut | 1 | |
| 2 | Spout | 1 | |
| 3 | Nut | 2 | |
| 4 | Cleat | 1 | |
| 5 | Plate | 2 | |
| 6 | Bolt | 10 | |
| 7 | Sponson | 2 | |
| 8 | Nut/washer | 4/4 | |
| 9 | Screw/washer | 4/4 | |
| 10 | Drain plug | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 11 | Packing | 2 | |
| 12 | Nut | 4 | **NOTE:** To remove the cleat, remove the exhaust system first. |
| 13 | Plate | 4 | |
| 14 | Cleat | 2 | |
| 15 | Packing | 2 | |
| 16 | Nut/washer | 3/3 | |
| 17 | Bolt | 4 | |
| 18 | Protector | 1 | |
| | | | Reverse the disassembly steps for assembly. |

# ENGINE MOUNT
## EXPLODED DIAGRAM



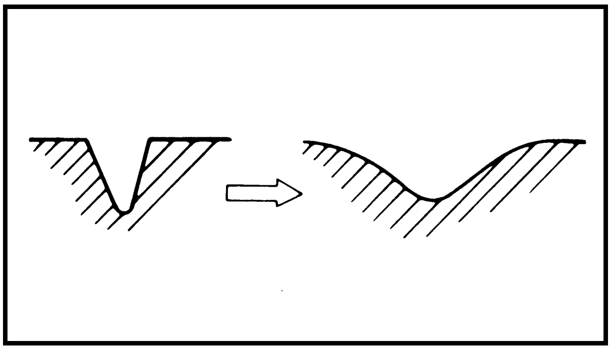

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **ENGINE MOUNT REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT" in Chapter 5. |
| 1 | Bolt | 4 | |
| 2 | Damper 1 | 1 | |
| 3 | Damper 2 | 1 | |
| 4 | Bolt | 8 | |
| 5 | Engine mount | 4 | |
| 6 | Liner | 2 | Stern side |
| | | | Reverse the removal steps for installation. |

## HULL REPAIR

### Shallow scratches

1. Sand the scratches with 400 grit sandpaper (either wet or dry) until the scratches are smooth. Then, sand the scratches once again with 600 grit sandpaper (either wet or dry).

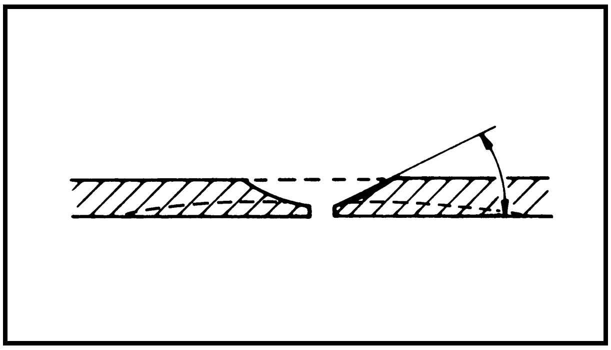


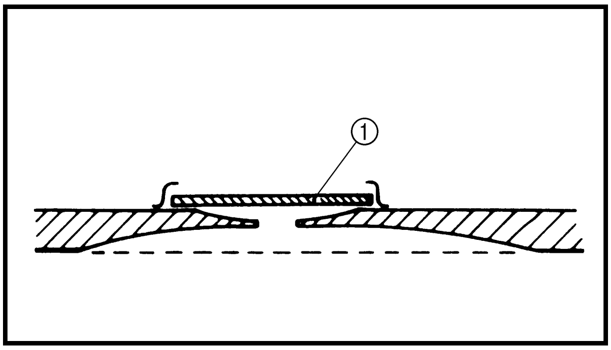
### Deep scratches

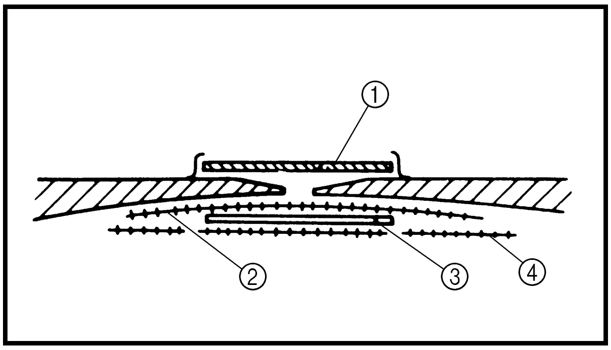
1. Remove any sharp or rough edges from the hull surface.
2. Sand the scratches and a 1-inch circumference around them with 80 grit sandpaper (either wet or dry).
3. Clean the entire area with acetone and let it completely dry.
4. Mix gel-coat and gel-coat thickener to form a putty, and then add the catalyst to the putty.
5. Apply the putty, spread it with a squeegee, and then cover the putty with wax paper.
6. When the putty has set, sand it. Smooth the area with 80–400 grit sandpaper (either wet or dry) and a sanding block.
7. Clean the area with a dry cloth and then polish it.

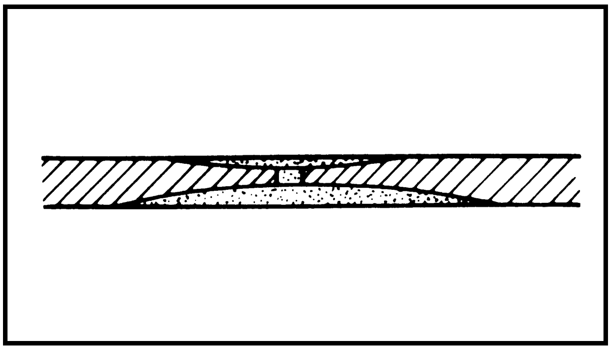
**⚠ WARNING**

**Resins, catalysts, and solvents are flammable and toxic; only use them in a well-ventilated area and keep them away from open flames and sparks. Always follow the manufacturer's instructions and warnings.**





**Cracks and punctures**

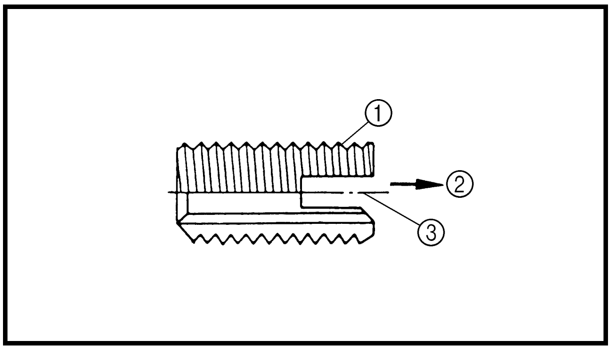
**NOTE:**
Before attempting to repair any cracks or punctures, refer to “WATERCRAFT FRP REPAIR MANUAL”.

1. Remove any damaged fiberglass.
2. Cut the damaged area and separate it approximately 0.25 inch.
3. On the outside of the hull, grind the separated edge of the area to less than 5° as shown.
4. Working from inside the hull, grind the damaged area approximately 4 inches beyond the damage.
5. Clean the area with acetone, apply BP-1 or an equivalent primer onto both sides of the damaged area, and then allow it to cure for approximately 30 minutes.
6. Cover a piece of cardboard with wax paper ① and then cover the damaged area with it.
7. Combine the polyester resin and the catalyst, and then apply the mixture onto the hull.
8. Install a glass mat ② (2 inches smaller than the ground area).
9. Apply the resin.
10. Install a 20 oz. fiberglass cloth ③ (1 inch smaller than the glass mat).
11. Apply the resin.
12. Install another glass mat ④ (1 inch smaller than the ground area).
13. When the resin has hardened remove the piece of cardboard.
14. Finish the outer surface.
    Refer to steps (3)–(7) in the “Deep scratches” section.

**Insert nut**

**NOTE:**
Use the insert nut when:
- A pop nut which was attached to the hull slipped off or,
- When a bolt which was fastened to an insert nut or pop nut broke.

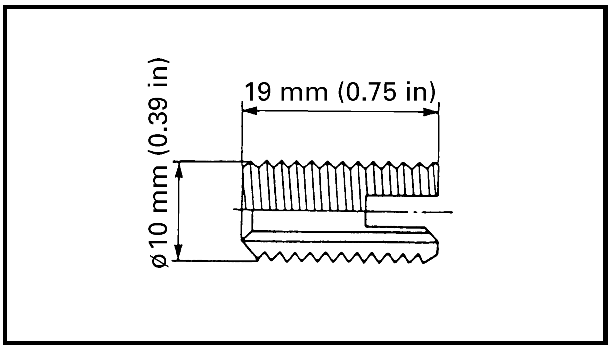
| Part No. | Part name | Remarks |
|---|---|---|
| EW2-62733-09 | Nut | Stainless steel, M6 |




- Nut ①
- Thread direction ②
- Slot to be threaded ③

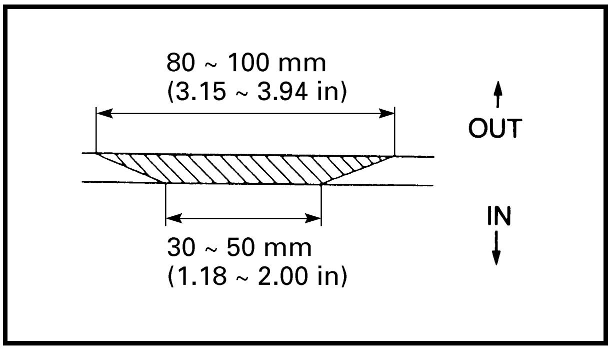
**NOTE:**
Drilling size

| Material | Pilot hole diameter |
|---|---|
| FRP or SMC | 9.1–9.2 mm (0.36 in) |
| Brass | 9.4 mm (0.37 in) |



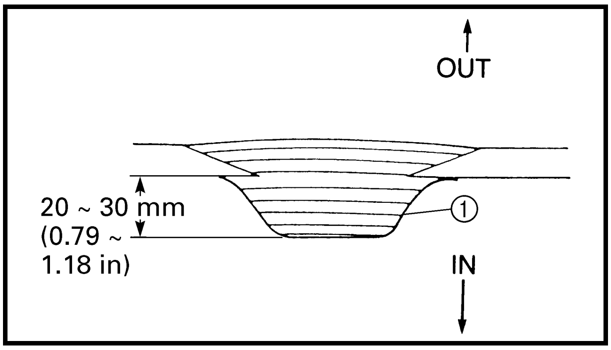

Example 1:

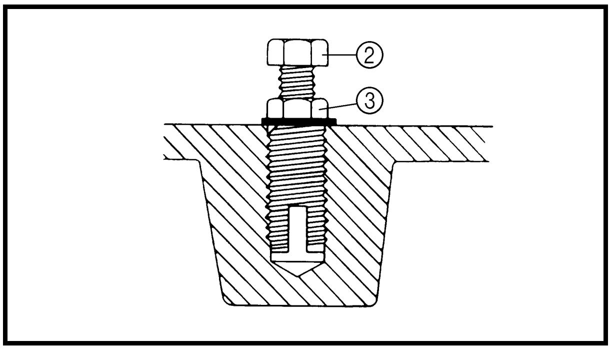
**NOTE:**
Before attempting to install the insert nut, refer to “WATERCRAFT FRP REPAIR MANUAL”.




The insert nut is used to repair the pop nut designed for the ride plate.
(By repairing the FRP portion, the insert nut can be used for all models.)

1. Remove:
   - Pop nut
2. Clean the surface to be scarfed and the inside of the hull with acetone.
3. Scarf the shaded portion of the hull.




4. First, apply tape ① to the inner surface of the hull and then laminate fiberglass mats over the tape with resin.

**NOTE:**
When it is possible to work inside the hull, laminate the mats from the inside.

5. Sand the outer surface of the hull until it is smooth.
6. Install the ride plate.
7. Drill a 20 mm (0.79 in) deep hole in the center of the laminated fiberglass layers with a 9.2 mm (0.36 in) diameter drill bit.
8. Pass the bolt ② through the insert nut and lock the bolt with the nut ③ as shown.
9. Screw in the insert nut so that the top is flush with the FRP surface.
10. Loosen the locknut and remove the bolt.

**CAUTION:**
- **Only use a steel bolt with a tensile strength of 8T or more.**
- **If the bolt is inferior in strength or is made of stainless steel it may break.**

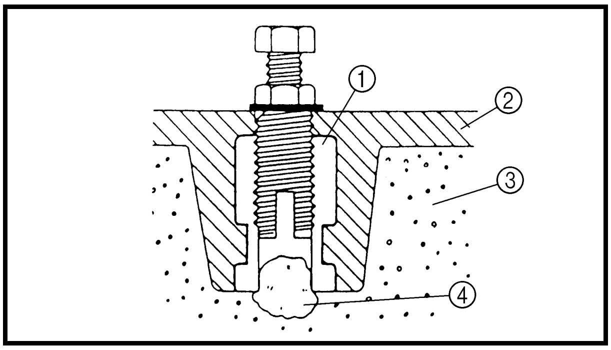
- Bolt ②
- Locknut ③

Example 2:
The brass insert nut, which is designed for the Super Jet ride plate or the intake screen, is used as follows.

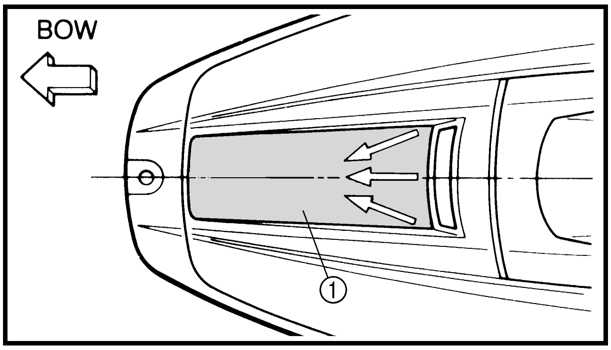
**NOTE:**
If the bolt is broken, drill it out.

1. Drill a hole in the hull.

**NOTE:**
- First, use a small-diameter drill bit followed by drill bits of gradually increasing diameter.
- Use a 9.4 mm (0.37 in) drill bit for the final drilling.

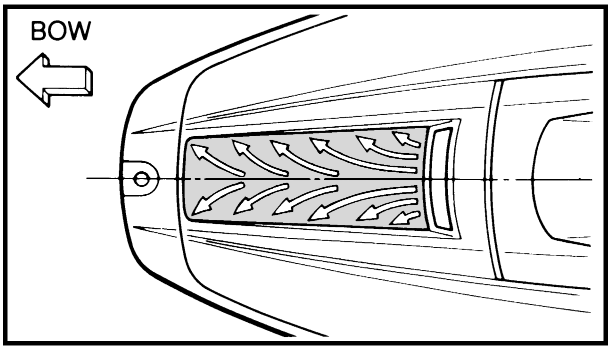



2. To prevent water from entering the urethane foam, apply silicone sealant to the inside of the hole as shown.
3. Install the insert nut as explained in “Example 1”.
   - Brass insert nut ①
   - Hull ②
   - Urethane foam ③
   - Silicone sealant ④




**Graphic removal**

1. Hold a hair dryer approximately 1.5 inches above the graphic ①.
2. Apply heat to one corner of the graphic.
3. Slowly peel off the heated portion of the graphic and continue working until you reach the opposite corner and the entire graphic is removed.
4. After the graphic is removed, clean the entire bow area with isopropyl alcohol to remove any residual adhesive.




**Graphic installation**

1. Mix 1 tablespoon of liquid detergent and water in a 1-quart spray bottle.
2. Remove the backing from the new graphic.
3. Spray the soap and water mixture onto both sides of the graphic, and also onto the hull area where the graphic will be installed.

**NOTE:**
Spraying the front of the graphic with the soap and water mixture will protect it from being scratched during installation.

4. Align the graphic onto the fitting area of the hull and position it with a squeegee.

**NOTE:**
Be sure to remove any air bubbles from the graphic with the squeegee. Work from the top of the graphic down and slide the squeegee outwards from the graphic’s center line.

5. Allow the graphic to dry before waxing or using the watercraft.

# CHAPTER 9
# TROUBLE ANALYSIS

# INTRODUCTION
## FEATURES
The newly developed Yamaha Diagnostic System provides quicker detection and analysis of engine malfunctions for quicker troubleshooting procedures than traditional methods.
By connecting your computer to the ECM (Electronic Control Module) of a watercraft using the communication cable, this software can be used to display sensor data and data stored in the ECM on a computer's monitor.
If this software is run on Microsoft Windows® 95, Windows 98, Windows Me, Windows 2000, or Windows XP the information can be displayed in colorful graphics. Also, the software can be operated using either a mouse or a keyboard.
In addition, the data for the main functions (Diagnosis, Diagnosis record, Engine monitor, and Data logger) can be saved on a disk or printed out.

**Functions**
1. **Diagnosis:** Each sensor's status and each ECM diagnosis code or item are displayed. This enables you to find malfunctioning parts and controls quickly.
2. **Diagnosis record:** Sensors that had been activated and ECM diagnostic codes that have been recorded are displayed. This allows you to check the watercraft's record of malfunctions.
3. **Engine monitor:** Each sensor's status and the ECM data are displayed. This enables you to find malfunctioning parts quickly.
4. **Stationary test:** With the engine off, ignition, fuel injection, and the electric fuel pump are checked. These tests can be performed quickly.
5. **Active test:** With the engine running, each firing cylinder drops and the engine speed is checked for changes to determine if the cylinder is malfunctioning. These tests can be performed quickly.
6. **Data logger:** From the data stored in the ECM, at least two items of 78 seconds of recorded data are displayed on a graph. In addition, the operating time as compared to the engine speed and the total operating time are displayed. This allows you to check the operating status of the engine.
7. **ECM No.:** The ECM part number is displayed.

## CONTENTS
1. Software (1)
2. Adapter (1)
3. Communication cable (1)
4. Instruction Manual (1)
5. Installation Manual (1)
   (with CD-ROM)

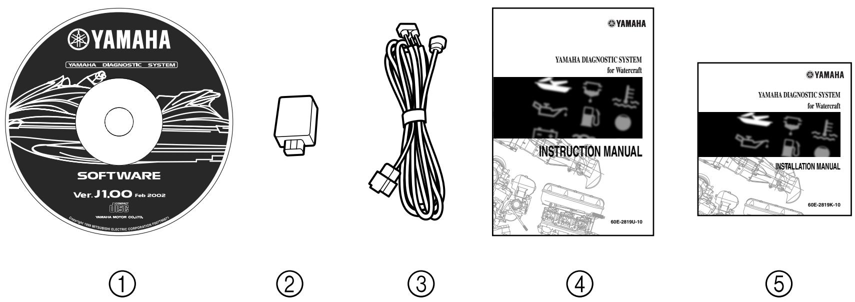



Fig. 1

## HARDWARE REQUIREMENTS

Make sure that your computer meets the following requirements before using this software.

| | |
|---|---|
| Computer: | IBM-compatible computer |
| Operating system: | Microsoft Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP (English version) |
| CPU: | |
| Windows 95/98: | i486X, 100 MHz or higher (Pentium 100 MHz or higher recommended) |
| Windows Me/2000: | Pentium, 166 MHz or higher (Pentium 233 MHz or higher recommended) |
| Windows XP: | Pentium, 300 MHz or higher (Pentium 500 MHz or higher recommended) |
| Memory: | |
| Windows 95/98: | 16 MB or more (32 MB or more recommended) |
| Windows Me: | 32 MB or more (64 MB or more recommended) |
| Windows 2000: | 64 MB or more (128 MB or more recommended) |
| Windows XP: | 128 MB or more (256 MB or more recommended) |
| Hard disk free space: | 20 MB or more (40 MB or more recommended) |
| Drive: | CD-ROM drive |
| Display: | VGA (640 × 480 pixels), (SVGA [800 × 600 pixels] or more recommended) 256 or more colors |
| Mouse: | Compatible with the operating systems mentioned above |
| Communication port: | RS232C (Dsub-9 pin) port |
| Printer: | Compatible with the operating systems mentioned above |

**NOTE:**

- The amount of memory and the amount of free space on the hard disk differs depending on the computer.
- Using this software while there is not enough free space on the hard disk could cause errors and result in insufficient memory.
- This software will not run properly on some computers.
- This software is not compatible with USB ports. Be sure to install it into a PC that has an RS232C (Dsub-9 pin) port.
- When starting up this program, do not start other software applications.
- Do not use the screen saver function or the energy saving feature when using this program.
- If the ECM is changed, restart the program.
- Window XP is a multiuser operating system, therefore, be sure to end this program if the login user is changed.

# GETTING STARTED

This section provides information on installing the Yamaha Diagnostic System under Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP.

## INSTALLING THE YAMAHA DIAGNOSTIC SYSTEM UNDER Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP

**NOTE:**

- Before installing the Yamaha Diagnostic System, check that your computer meets the specified requirements. For detailed information on the system requirements, see page 2.
- It is strongly recommended that you exit all other programs before running the installer.

1. Turn on your computer and start up Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP.
2. Insert the compact disc into the computer's CD-ROM drive.
3. Double-click the **My Computer** icon, then the **CD-ROM drive** icon, and then double-click the **Setup.exe** icon to start up the installer. (Fig. 2)

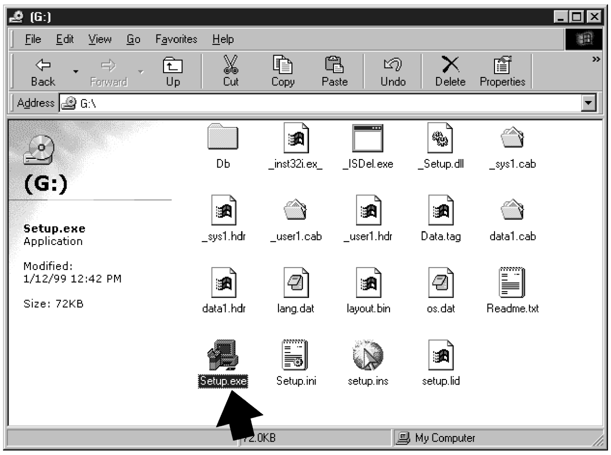



Fig. 2

4. Click the **Next** button to start the installation process. (Fig. 3)

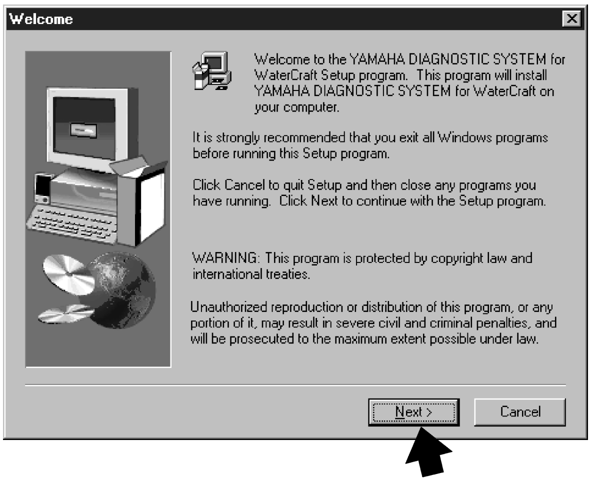



Fig. 3

**NOTE:**

If the Yamaha Diagnostic System has already been installed onto your computer, the following dialog box appears.

Click the **Yes** button to update this program, or click the **No** button to quit the installation. (Fig. 4)

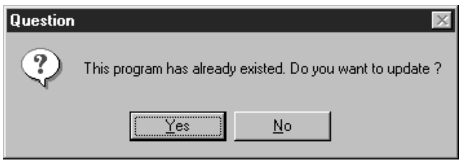



Fig. 4

**NOTE:**

- To quit the installation, click the **Cancel** button. The following dialog box appears.

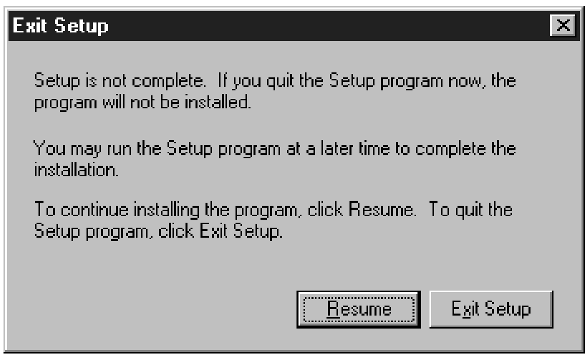



Fig. 5

- To quit the installation program, click the **Exit Setup** button.
- To resume the installation, click the **Resume** button. (Fig. 5)

5. Check the target directory and the program name for the Yamaha Diagnostic System which are displayed in the dialog box.
   Click the **Next** button to start copying the program files.

**NOTE:**
- To go back to the previous dialog box (step 4), click the **Back** button.
- To quit the installation, click the **Cancel** button.

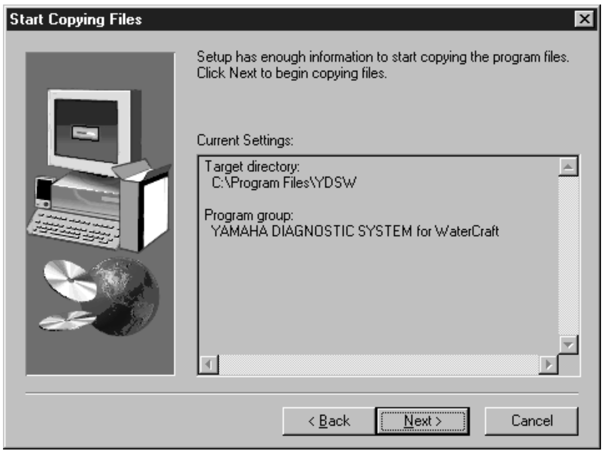



Fig. 6




Fig. 7

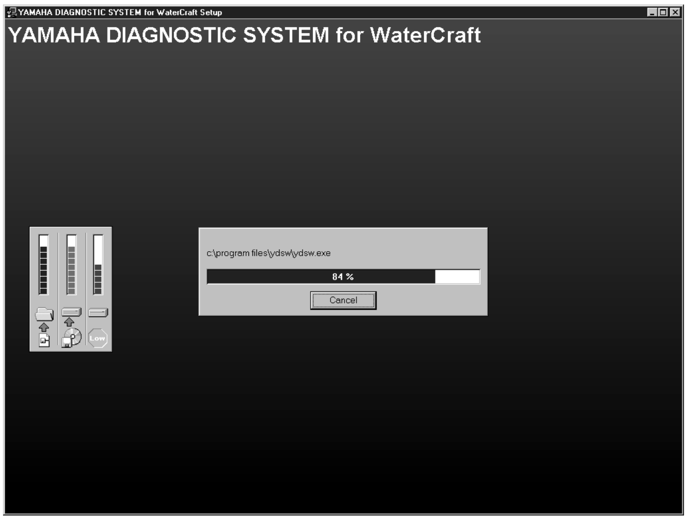



Fig. 8

6. After the installation is completed, the following dialog box appears.
   Click the **Finish** button to quit the installation program.

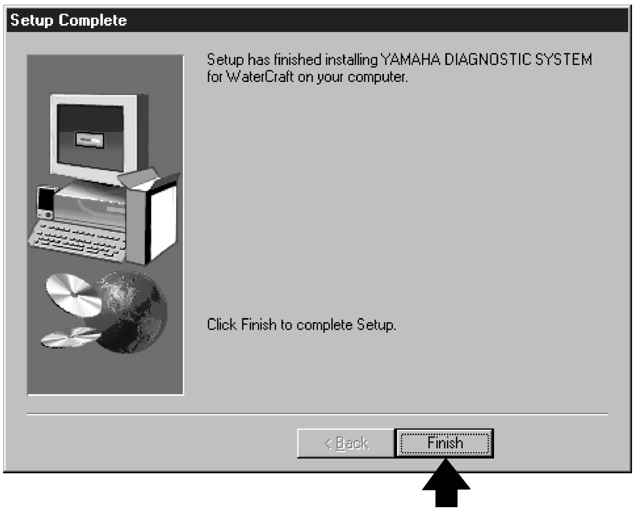



Fig. 9

**NOTE:**

Install the Database file before using the Yamaha Diagnostic System, otherwise the program will not operate correctly. For installation procedures, refer to "UPDATING THE DATABASE" on the next page.

## UPDATING THE DATABASE

**NOTE:**
When installing the Yamaha Diagnostic System for the first time, be sure to update the database.

1. Turn on your computer and start up Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP.
2. From the taskbar at the bottom of your computer screen, click the **Start** button (fig. 10), point to **Programs**, and then click **YAMAHA DIAGNOSTIC SYSTEM for WaterCraft** to open the Yamaha Diagnostic System window. (Fig. 11)

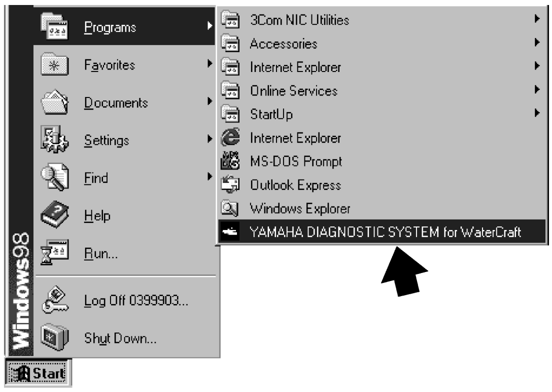



Fig. 10

3. After about three seconds the display will automatically go to the first menu display, or you can click or press any key to go to the first menu. (See fig. 12.)




Fig. 11

4. Click the **Update database [F1]** button or press the F1 key on your keyboard. (Fig. 12)

①

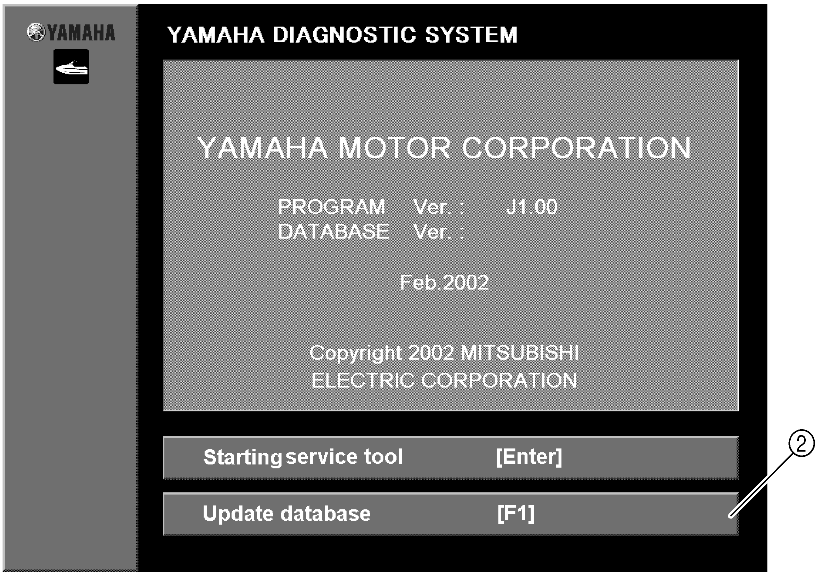



Fig. 12

① First menu
② Click to update database

**NOTE:**
- Do not click the **Starting service tool [Enter]** button or press the Enter key on your keyboard until the database has been updated, otherwise the program will not operate correctly.
- To quit the update of the database, press the ESC key on your keyboard.

5. Insert the compact disc into the computer's CD-ROM drive.

**NOTE:**
- All the database files will be copied from the compact disc to the computer's hard drive automatically.
- Any earlier version of the database saved on the hard drive will be overwritten.

6. Click the **OK** button or press the Enter key on your keyboard to start copying the database files. (Fig. 13)

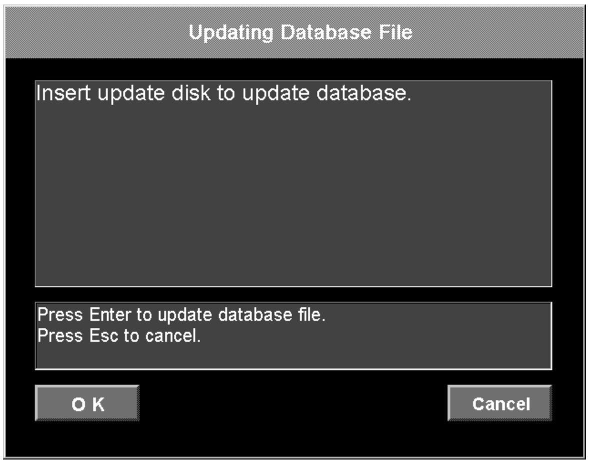



Fig. 13

**NOTE:**
If an error message appears and the program stops operating, follow the error message. (Fig. 14)




Fig. 14

7. When the database is updated a confirmation screen is displayed.
   To quit, click the **OK** button or press the Enter key on your keyboard. (Fig. 15)
   To return to the first menu screen, click the **Cancel** button or press the Esc key on your keyboard.

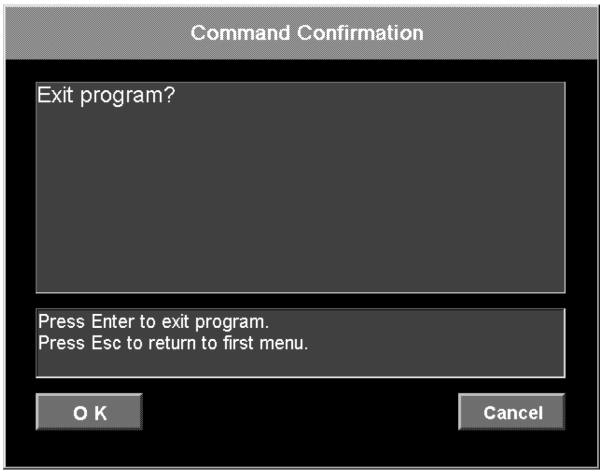



Fig. 15

**NOTE:**

If the OK button is clicked, the program is exited.
Start the program again and check that the database version indicated in the first menu is J1.00. (Fig. 16)

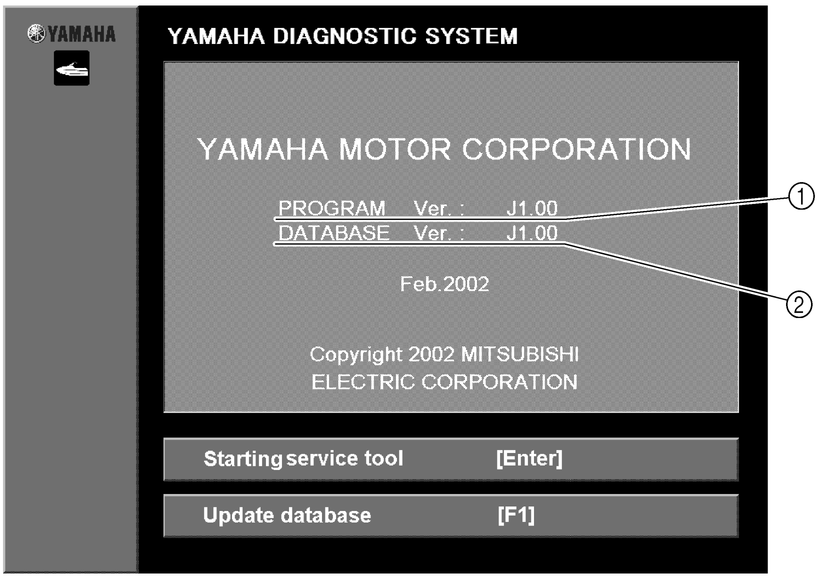



Fig. 16

① Program version
② Database version

# OPERATING

## CONNECTING THE COMPUTER TO THE WATERCRAFT

**NOTE:**
Be sure to use the enclosed communication cable to connect the computer and adapter to the watercraft.

1. Quit any applications that are running, and then turn off the computer.
2. Connect the communication cable to the 3-pin communication coupler of the watercraft, the adapter, and the communication port of your computer.

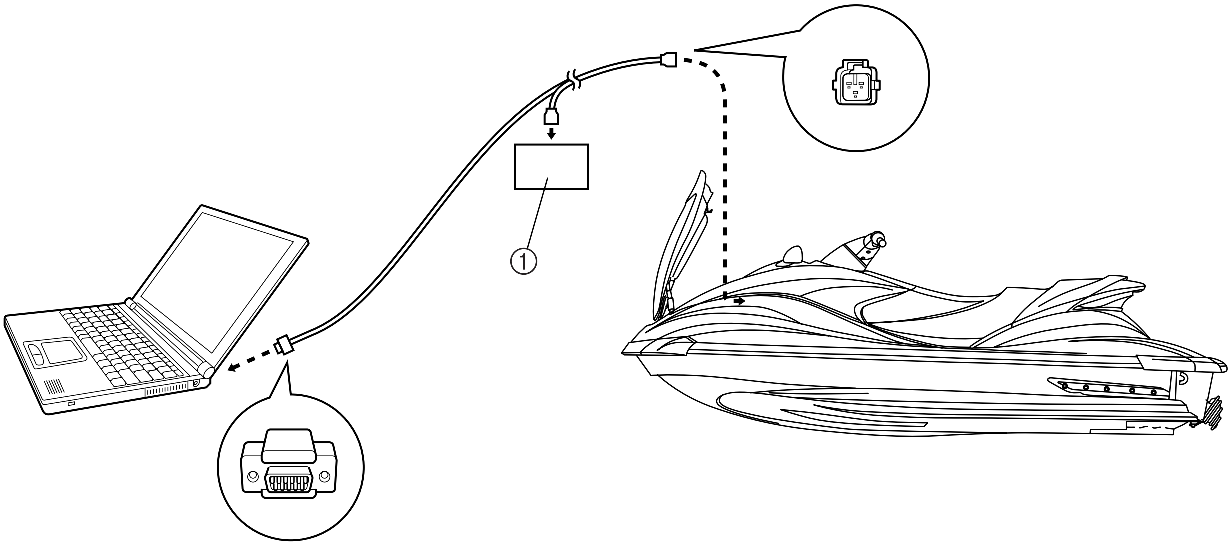



Fig. 17

① Adapter

**NOTE:**
Use either the COM1 or COM2 port, and, if necessary, set the serial port as specified in the computer's manual. Set the serial port where the RS232C (Dsub-9 pin) cable is connected to COM1 or COM2.

3. Connect a 12 V battery to the watercraft.

**NOTE:**
The following items should be checked before starting the Yamaha Diagnostic System.
- The battery is properly charged and its specific gravity is within specification.
- There are no incorrect wiring connections.
- Wiring connections are properly secured and are not rusty.
- There is enough fuel in the fuel tank.

## CONNECTING THE COMMUNICATION CABLE TO THE WATERCRAFT

**Models: FX140**
**Top view**

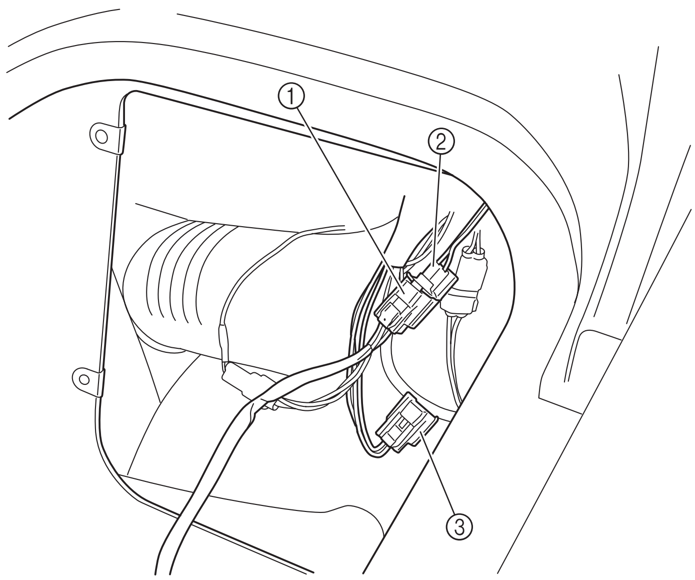



Fig. 18

① 3-pin communication coupler
② Wire harness coupler
③ Meter coupler

**NOTE:**
Be careful not to pinch the communication cable between the **hood** and the **deck** or to damage it.

## OPENING THE YAMAHA DIAGNOSTIC SYSTEM

1. Push the start switch to start the engine.
2. Turn on your computer and start up Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP.
3. From the taskbar at the bottom of your computer screen, click the **Start** button (Fig. 19), point to **Programs**, and then click **YAMAHA DIAGNOSTIC SYSTEM for WaterCraft**.

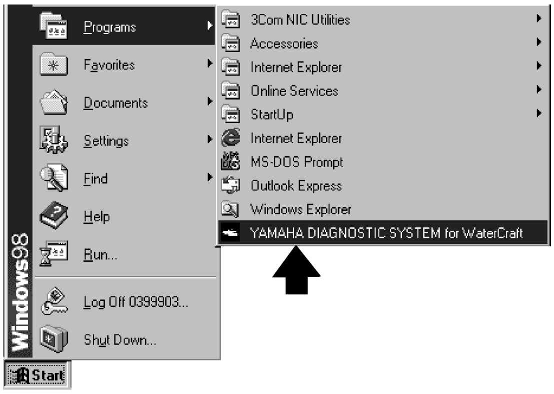



Fig. 19

4. Open the Yamaha Diagnostic System window. (Fig. 20) After about three seconds the display will automatically go to the first menu, or click or press any key to go to the first menu. (See fig. 21.)




Fig. 20

5. Click the **Starting service tool [Enter]** button or press the Enter key on your keyboard. (Fig. 21)

①

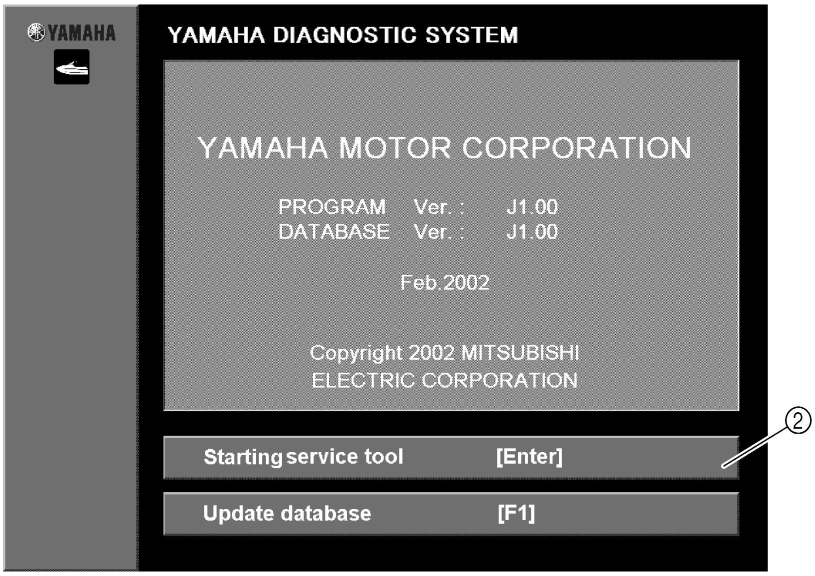



Fig. 21

① First menu
② Click to start service tool

**NOTE:**
- If an error message appears and the program stops operating, follow the error messages.
- If the program doesn't start, an error message will explain the problem. If the program doesn't start and an error message is not displayed, the cause of the problem is most likely insufficient computer memory.
- To cancel, press the ESC key on your keyboard.

6. Click or press any key to display the main menu.

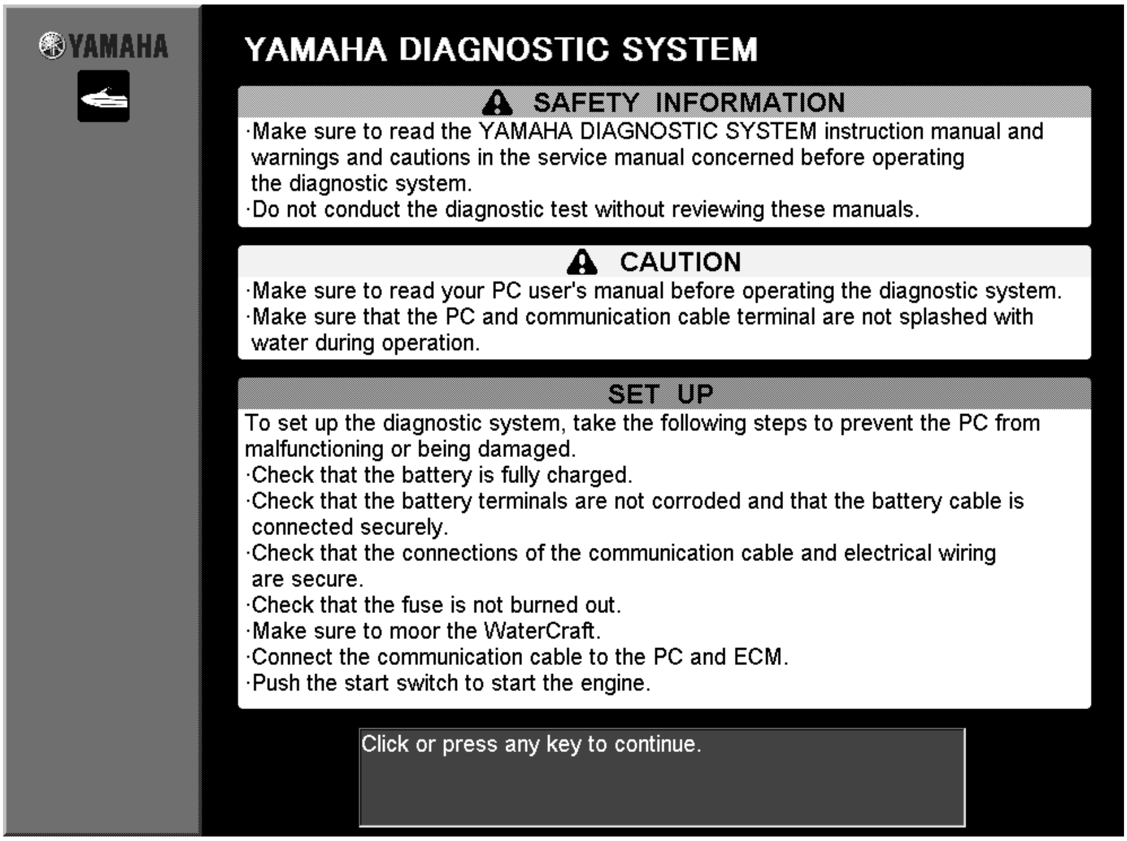



Fig. 22

**NOTE:**

If a diagnosis record is stored in the ECM, “Diagnosis record available,” appears as a confirmation message before the Main Menu is displayed. (Fig. 23)




Fig. 23

## SELECTING COMMANDS FROM THE MAIN MENU

Eight commands appear in the Main Menu. Select a command in any of the following three ways.

**Two ways to select command:**

- Move the mouse pointer over the selected command (ⓐ or ⓑ) until it appears as a finger mark, and then click the selected command.
- Press the number key (1–8) corresponding to the selected command.

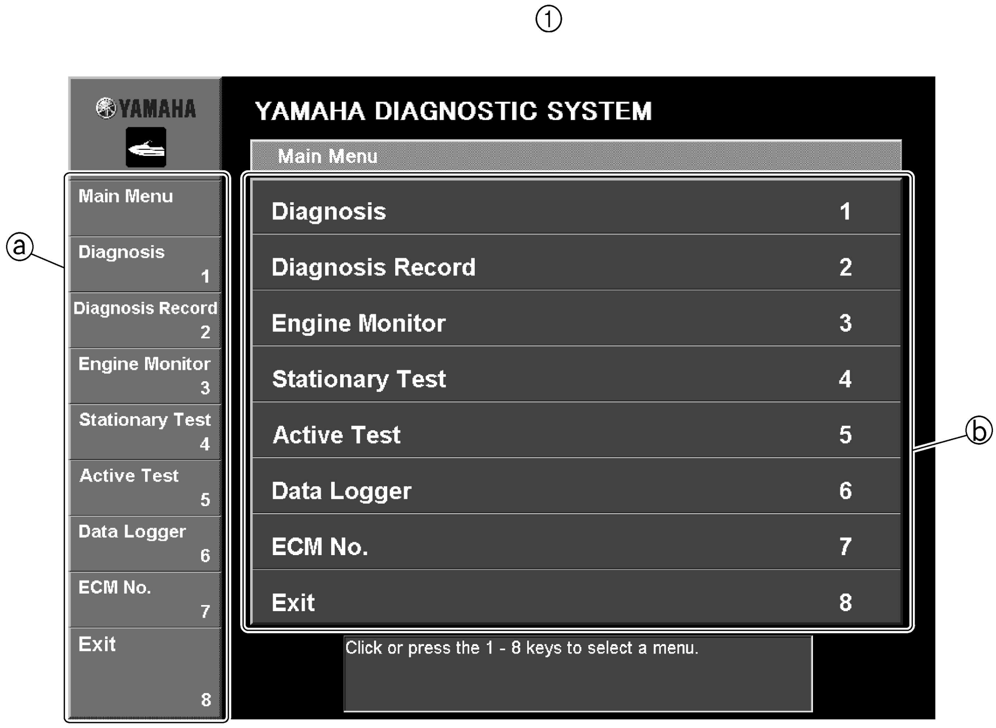



Fig. 24

① Main menu

**NOTE:**

If the Main Menu is displayed and the engine is turned off, electric power is supplied to the ECM for 30 minutes and commands can be carried out.

## EXPLANATION OF EACH COMMAND

### 1. Diagnosis

The diagnosis codes, their corresponding part name, the diagnosing results, and the diagnostic criteria are listed.
List of items:
Condition of coils (pulser coils)
Condition of sensors (throttle position sensor, intake air temperature sensor, intake air pressure sensor, engine temperature sensor, and cam position sensor)
Condition of battery (battery voltage)
Operation of switches (slant detection switch)

### 2. Diagnosis record

The diagnosis code, its corresponding part name, oil pressure warning, overheat warning, the time of occurrence, and the total operation hours are listed. This command enables you to check the record of malfunctions, which will assist in reducing troubleshooting time. In addition, the diagnostic codes of malfunctions that have occurred can be deleted from the ECM.
The items are the same as those listed above for *Diagnosis*.

### 3. Engine monitor

The input signal of each sensor for the ECM is displayed.
In addition, the sensing item that is displayed can be changed.
Sensing items:
Sensors (throttle position sensor, intake air temperature sensor, intake air pressure sensor, and engine temperature sensor)
Voltage system (battery voltage)
Switches (engine shut-off switch, oil pressure switch, thermoswitch, and slant detection switch)
Operation signals (ignition and injectors)

### 4. Stationary test

With the engine off, operation tests are performed.
Test items:
Spark ignition coil for each cylinder
Fuel injector for each cylinder
Operation of the electric fuel pump

### 5. Active test

With the engine running, operation tests are performed.
Test items:
Dropped cylinder

**6. Data logger**

Two out of six items (engine speed, battery voltage, throttle position, intake air pressure, engine temperature, and oil pressure) are selected and 78 seconds of their recorded data are displayed on a graph. The operating time as compared to the engine speed and the total operating time are also displayed.

**7. ECM No.**

The ECM part number and model information are displayed.

**8. Exit**

The program is exited.

## DIAGNOSIS

The diagnosis codes of malfunctions recorded in the watercraft's ECM, the diagnosis codes' corresponding part name, the results of the diagnosis, and the condition of the part are listed.
Eight items can be displayed at one time.

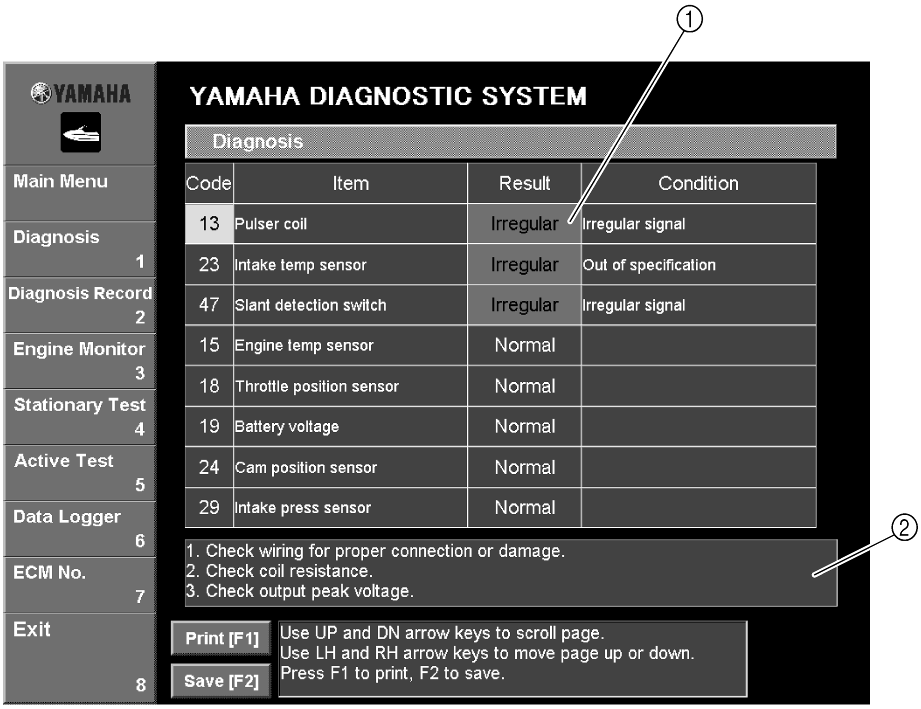



Fig. 25

① Other than Normal will be highlighted in red and will be listed from the top
② Displays troubleshooting procedures for selected code.

**Operating procedure:**

Select the code number that you wish to view a diagnosis for by either clicking it or pressing the up or down arrow keys on your keyboard.

**NOTE:**

- Items where "Normal" does not appear in the **Result** column are displayed at the top of the list.
- The selected code is highlighted in light blue and its confirmation procedure is displayed below the table.

**Print**

By selecting the **Print** command in the Diagnosis, Diagnosis record, Engine monitor, or Data logger mode, the data from the corresponding window can be printed.

1. Click the **Print [F1]** button or press the F1 key on your keyboard. The **Print** dialog box is displayed. (Fig. 26)

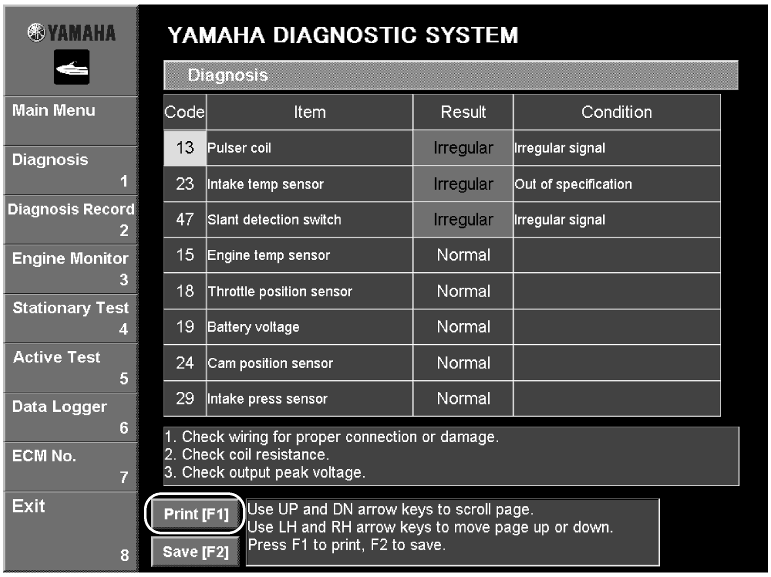



Fig. 26

2. Specify the printer, the printing range, and the number of copies to be printed.

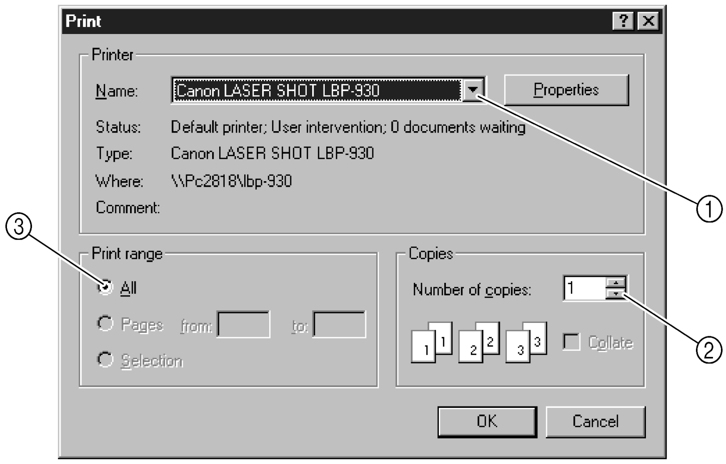



Fig. 27

① Select printer
② Select the number of copies
③ Select which page to print

3. Click the **OK** button to begin printing.
   To cancel printing, click the **Cancel** button.

**Save**

By selecting the **Save** command in the Diagnosis, Diagnosis record, Engine monitor, or Data logger mode, the corresponding data can be saved on a disk.

Operating procedure:

1. Click the **Save [F2]** button or press the F2 key on your keyboard. The **Save As** dialog box is displayed. (Fig. 28)

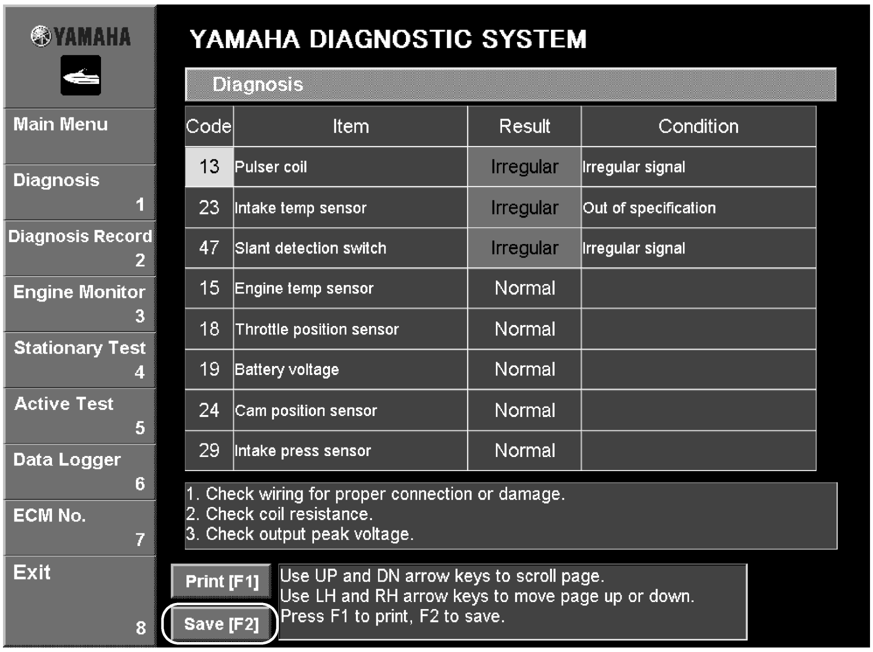



Fig. 28

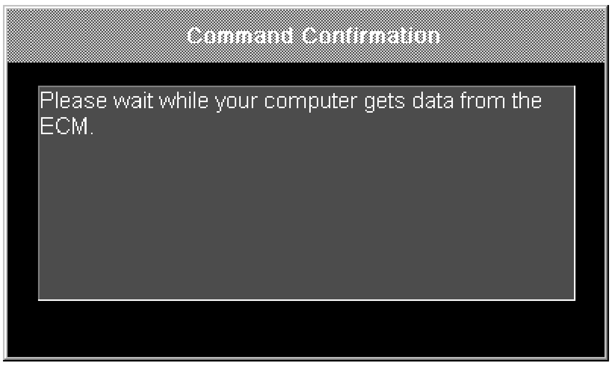



Fig. 29

2. Select the disk and folder where the data will be saved and specify its file name. (Fig. 30)

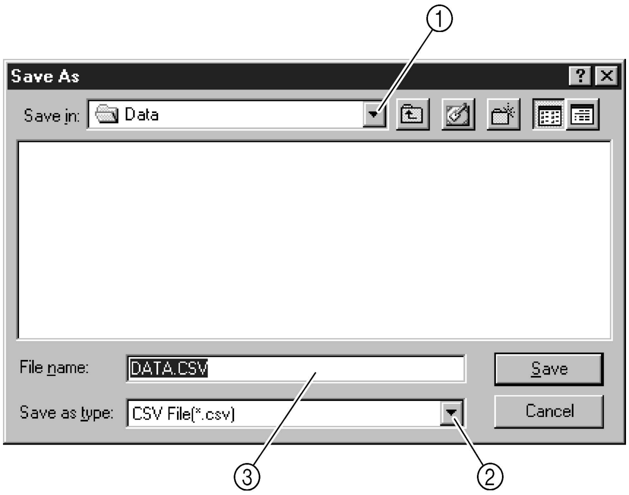



Fig. 30

① Choose folder to save in
② Choose type of data
③ Input file name

3. Click the **Save** button to save the data.
   To cancel saving, click the **Cancel** button. (Fig. 30)
   The data you saved can be viewed in Microsoft® Excel. (Fig. 31)

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Save date | September 10 2000 | | | |
| 2 | ECM No.: | 60E8591A01 | | | |
| 3 | | | | | |
| 4 | Diagnosis | | | | |
| 5 | | Code | Item | Result | Condition |
| 6 | | 15 | Engine temp sensor | Irregular | Out of specification |
| 7 | | 13 | Pulser coil | Normal | |
| 8 | | 18 | Throttle position sensor | Normal | |
| 9 | | 19 | Battery voltage | Normal | |
| 10 | | 23 | Intake temp sensor | Normal | |
| 11 | | 24 | Cam position sensor | Normal | |
| 12 | | 29 | Intake press sensor | Normal | |
| 13 | | 47 | Slant detection switch | Normal | |
| 14 | | | | | |
| 15 | Diagnosis Record | | | | |
| 16 | | Total hours of operation: | 0 | | |
| 17 | | Code | Item | Occurred | |
| 18 | | | Low oil pressure warning | 0.05 | |
| 19 | | 15 | Engine temp sensor | 0.05 | |
| 20 | | | | | |
| 21 | Engine Monitor | | | | |
| 22 | | Monitor Item | Result | Unit | |
| 23 | | Engine speed | 0 | r/min | |
| 24 | | Intake pressure | 100.42 | kPa | |
| 25 | | Intake pressure | 29.66 | inHg | |
| 26 | | Atmospheric pressure | 1004.2 | hPa | |
| 27 | | Atmospheric pressure | 29.7 | inHg | |
| 28 | | Ignition timing | - | deg | |
| 29 | | Battery voltage (12-16) | 12.23 | V | |
| 30 | | TPS voltage (0.5-4.5) | 0.762 | V | |
| 31 | | Throttle valve opening (0-90) | 1.5 | deg | |
| 32 | | Fuel injection duration | 0 | ms | |
| 33 | | Engine temperature (below 120) | 34 | -C | |
| 34 | | Engine temperature (below 248) | 93.2 | -F | |
| 35 | | Intake temperature (below 70) | 21 | -C | |
| 36 | | Intake temperature (below 158) | 69.8 | -F | |
| 37 | | Engine stop lanyard switch | OFF | | |
| 38 | | Overheat thermoswitch | OFF | | |
| 39 | | Slant detection switch | OFF | | |
| 40 | | Oil press switch | ON | | |
| 41 | | | | | |

Fig. 31

## DIAGNOSIS RECORD

The diagnosis codes of malfunctions that have been recorded in the watercraft's ECM, the diagnostic codes' corresponding part name, and the time when the malfunctions occurred are listed.
A maximum of five items can be displayed at one time. The oldest occurrence appears on top. In addition, diagnosis codes stored in the ECM can be deleted.

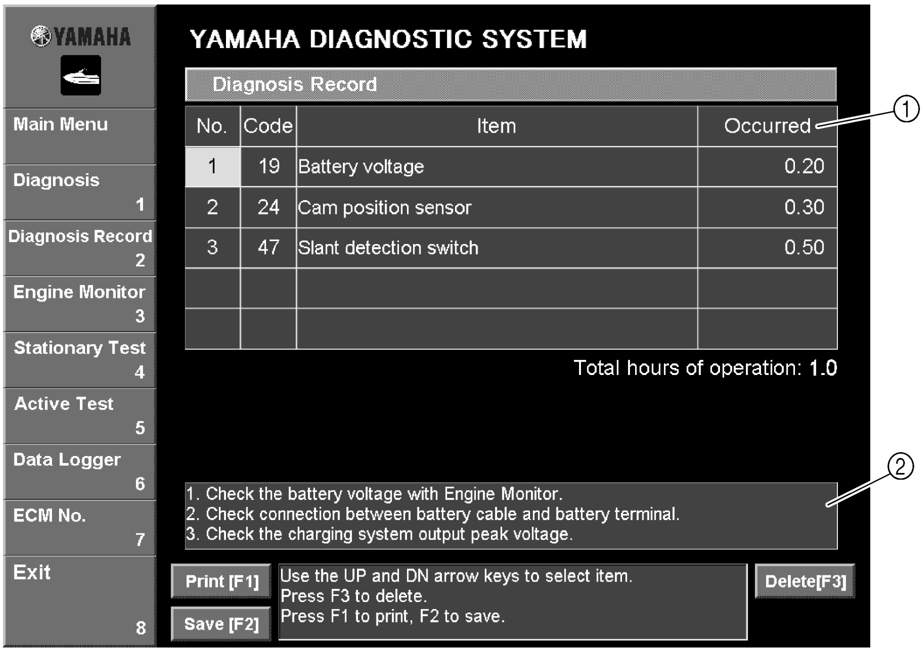



Fig. 32

① Displays time of occurrence
② Displays troubleshooting procedures for selected code.

**NOTE:**

When a Diagnosis record is not available, "Diagnosis Record is unavailable" is displayed. (Fig. 33)

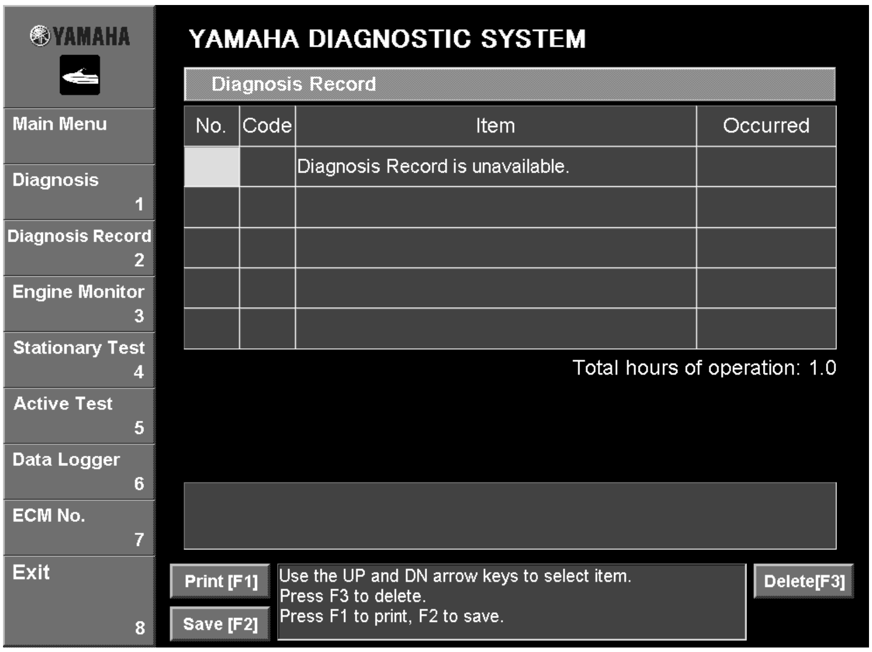



Fig. 33

**Deleting diagnosis record in the ECM:**

1. Select the item that you wish to delete by either clicking it or pressing the up or down arrow keys on your keyboard.

**NOTE:**

- The selected code is highlighted in light blue.
- Check that the items deleted are normal in the Diagnosis Record. If the items remain irregular, they will appear as irregular in the Diagnosis Record even if you try to delete them they are undeletable.

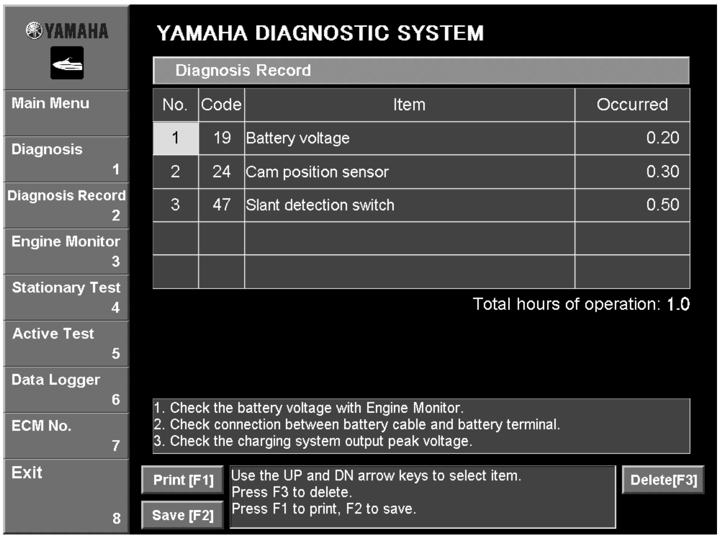



Fig. 34

2. Click the **Delete [F3]** button or press the F3 key on your keyboard. (See fig. 33.) A confirmation message appears. (Fig. 35)

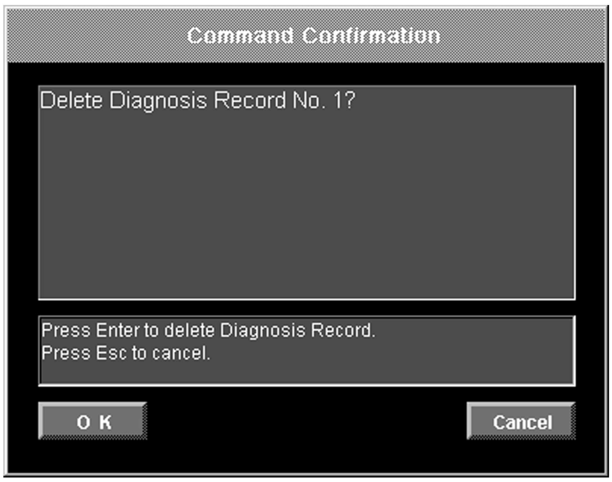



Fig. 35

3. Click the **OK** button or press the Enter key on your keyboard. (Fig. 35) The selected item is deleted. To cancel deleting the item, click the **Cancel** button or press the Esc key on your keyboard.

**NOTE:**

If an error occurs while an item is being deleted, an error message appears. Follow the instructions that appear in the error message. (Fig. 36)




Fig. 36

## ENGINE MONITOR

**WARNING**

**Do not use the Engine Monitor function to check the engine condition while operating a watercraft, otherwise you could become distracted, which could result in a collision.**

**CAUTION:**

**Be sure to avoid splashing water on the computer, adapter, and communication cable, and to avoid damaging them with strong sudden jolts or vibration.**

The data from the ECM of the watercraft is displayed.
Ten items can be displayed at one time. To view the other items, scroll the display. Displayed items can be changed as necessary.

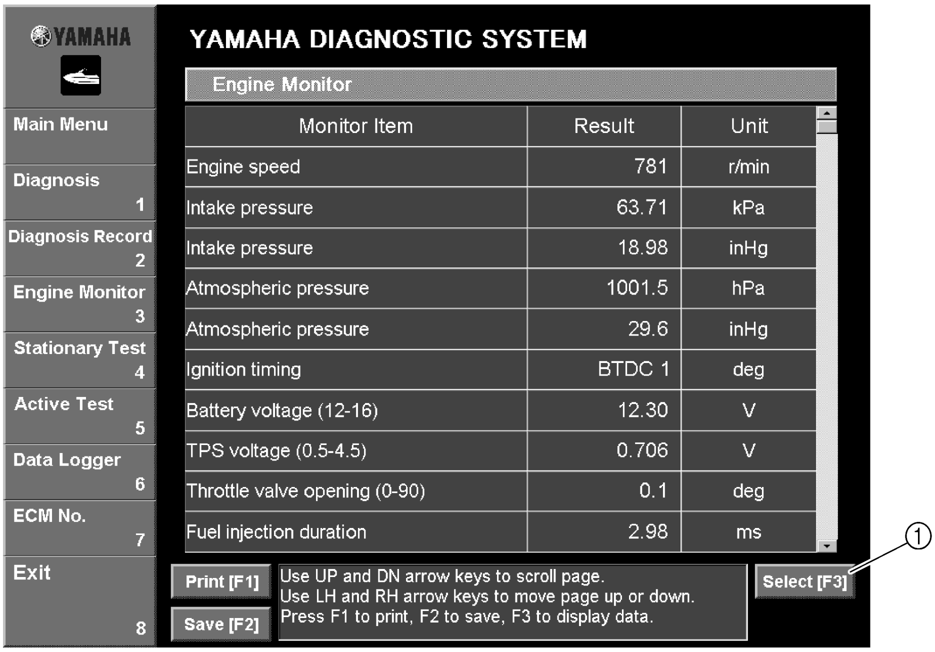



Fig. 37

① Click to go to item selection display

**Operating procedure:**

1. To scroll the display and view other items, click ▲ or ▼ in the scroll bar, or press the up or down arrow keys on your keyboard.
2. To change a displayed item, click the **Select [F3]** button or press the F3 key on your keyboard.
3. Select an item by either clicking it or pressing the up or down arrow keys on your keyboard, and then press the space bar. (Fig. 38)

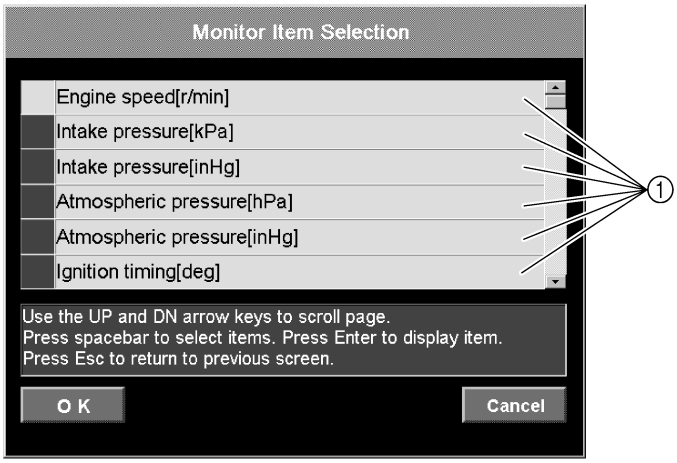



Fig. 38

① Selected items

**NOTE:**

- Selected items have a light blue background. Items that are not selected have a blue background. The box to the left of items that are being moved are light blue. Items that are not selected appear in blue.
- At initialization, all items are displayed.

4. Click the **OK** button or press the Enter key on your keyboard. The **Engine monitor** window appears. To cancel the monitor, click the **Cancel** button or press the Esc key on your keyboard. (Fig. 38)

## STATIONARY TEST

Selecting this command displays a window where stationary tests (spark ignition coil #, operate injector #, and operate electric fuel pump) can be selected.

**⚠ WARNING**

**Avoid clicking the Execute and Cancel buttons repeatedly, otherwise the ECM or PC will not work properly and they could be damaged.**

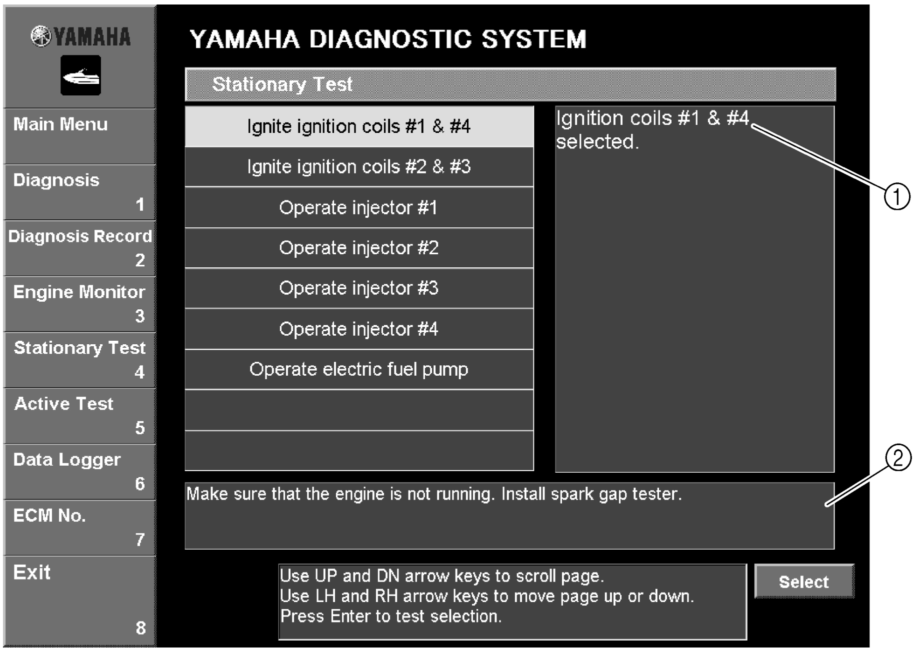



Fig. 39

① Explanation of selected item
② Confirmation item before the test

### Sparking ignition coil procedure:

A voltage is applied to the ignition coil of the selected cylinder, a spark is created in the spark gap tester, and then the ignition system is checked. Five sparks are created within five seconds.

**⚠ WARNING**

- **Do not touch any connections of the spark gap tester lead wires.**
- **Do not let sparks leak out of the removed spark plug cap.**
- **Keep flammable gas or liquids away since this test will produce sparks.**

1. Select the test that you wish to perform by either clicking it or pressing the up or down arrow keys on your keyboard. (Fig. 39)

**NOTE:**
- Make sure that the engine is not running.
- The selected item is highlighted in light blue.
- The details of the selected test are displayed in the column on the right, and the items that must be either checked or performed before the test can start are displayed below the table.
- Only one item can be selected at one time.
- A special tool (spark gap tester YM-34487/90890-06754) is needed.

2. Connect the spark plug cap of the cylinder that will be tested to the spark gap tester.
   Spark gap tester
   [A] YM-34487 / [B] 90890-06754
3. Set the spark gap length on the adjusting knob.
   Ignition spark gap: 7–8 mm (0.28–0.31 in)

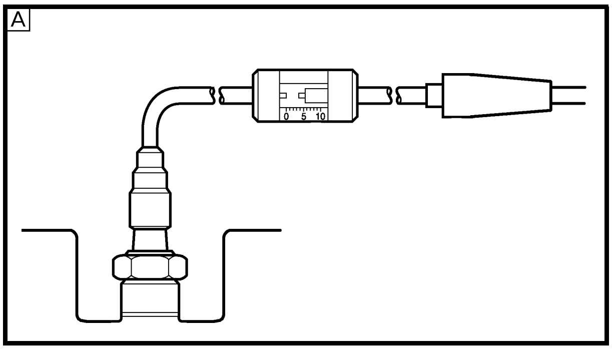


Fig. 40

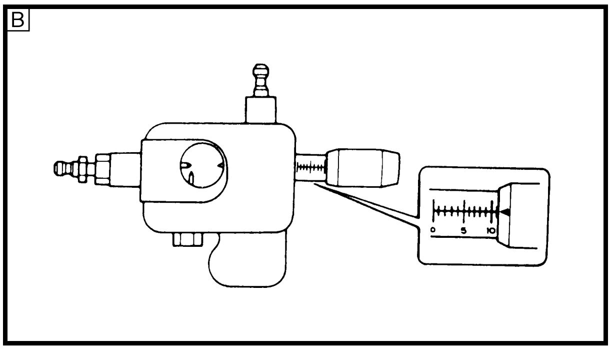


Fig. 41

4. Select the cylinder number where the spark gap tester is connected, and then click the **Select** button or press the Enter key on your keyboard. (Fig. 39)

5. Click the **Execute** button or press the Enter key on your keyboard. (Fig. 42)

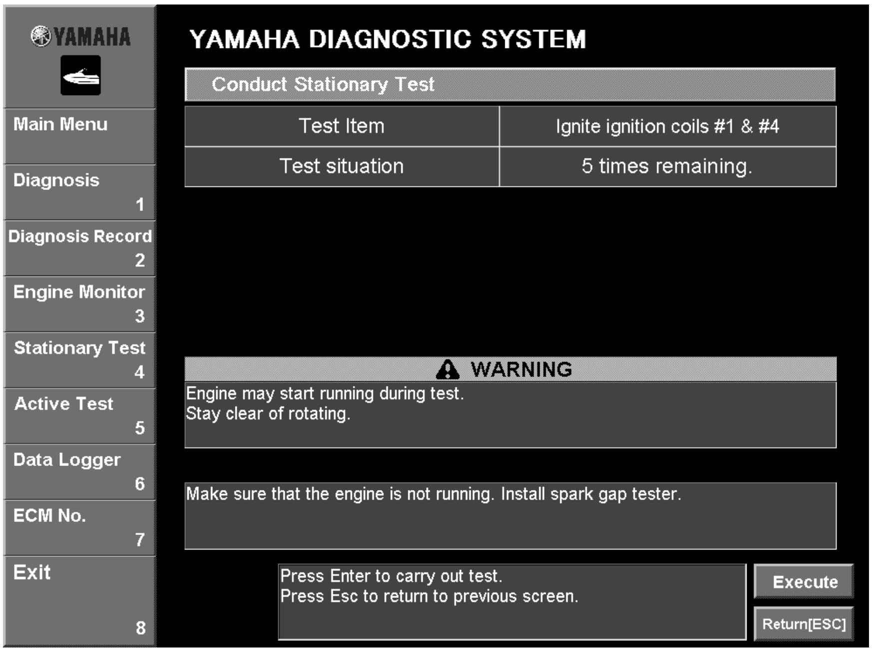



Fig. 42

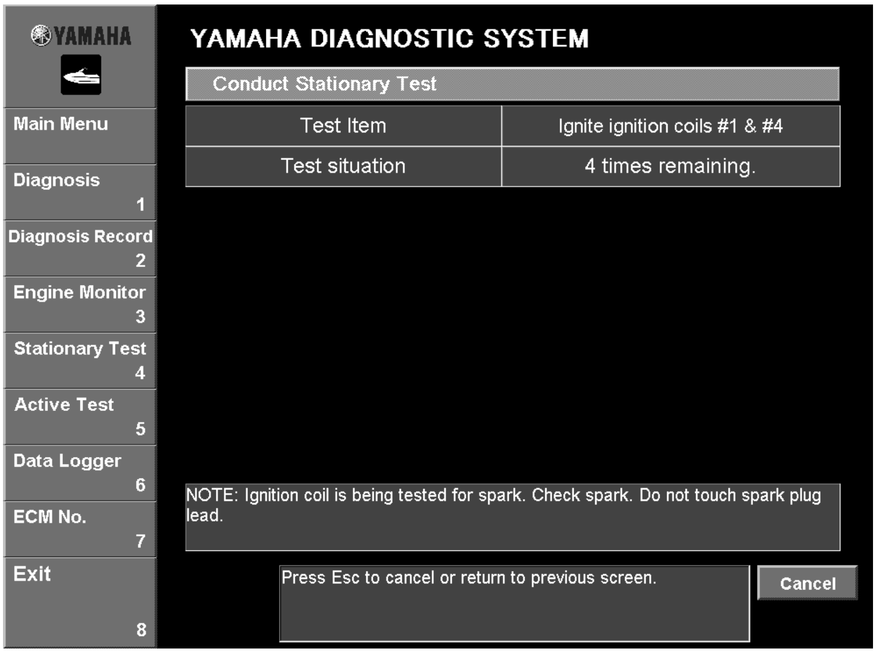



Fig. 43

**NOTE:**

If the engine is running an error message is displayed. Follow the instructions that appear. (Fig. 44)

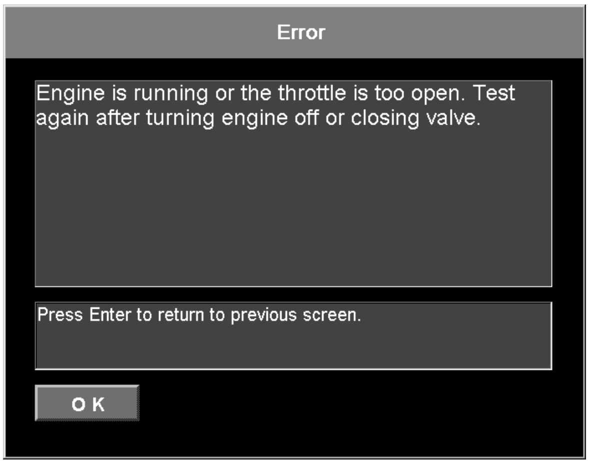



Fig. 44

6. While checking the information that appears in the **Test situation** column, follow the test instructions in the messages that are displayed. (See fig. 43.)

**NOTE:**

If an error occurs while the test is being performed, an error message is displayed. Follow the instructions that appear in the error message. (Fig. 45)

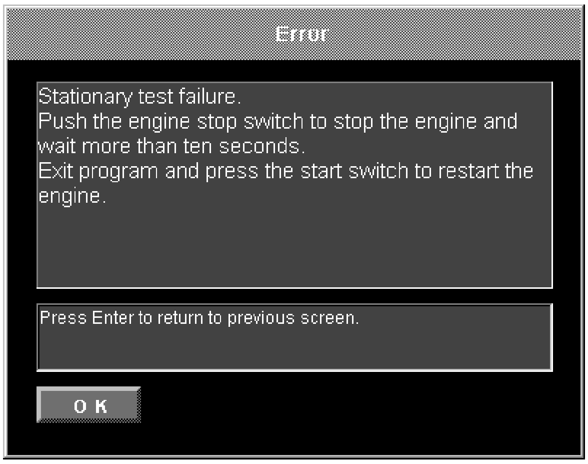



Fig. 45

7. To stop the stationary test, click the **Cancel** button. (See fig. 43.)
8. Observe the spark through the discharge window of the spark gap tester.

9. To perform the test again to the same cylinder, click the **Execute** button or press the Enter key on your keyboard. To perform the test on a different cylinder, click the **Return [ESC]** button or press the Esc key on your keyboard to return to main menu where a different test can be selected. (Fig. 46)

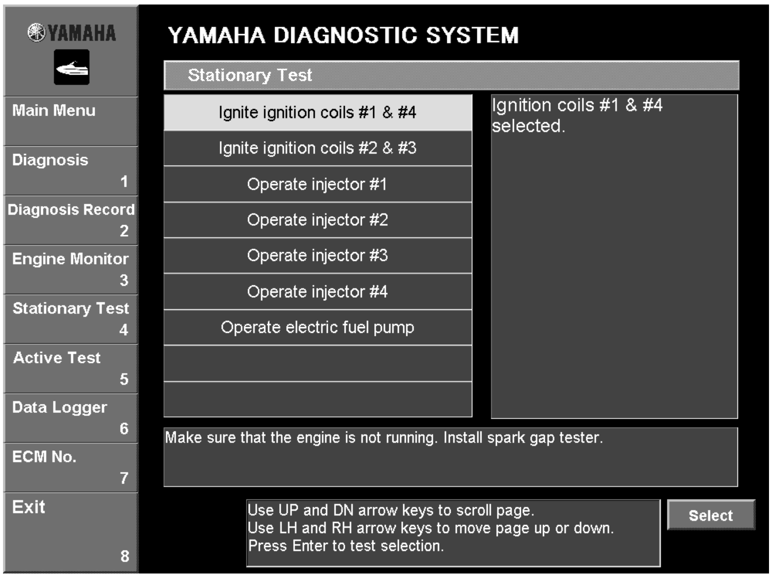



Fig. 46

**NOTE:**
If an error occurs while the test is being performed, the following message is displayed. (Fig. 47)

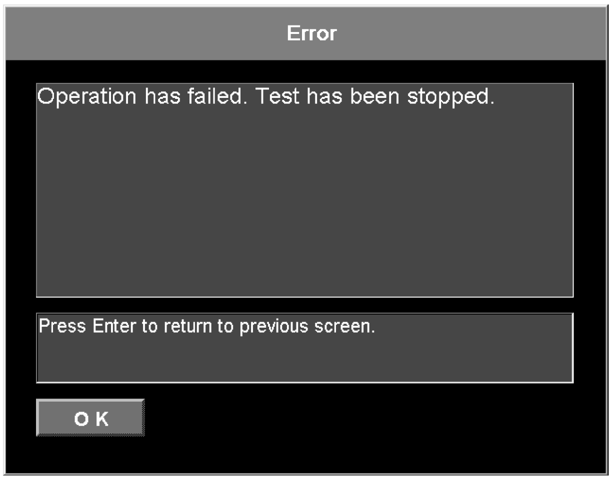



Fig. 47

**Operating injector procedure:**

A voltage is applied to the injector of the selected cylinder, the injector is activated, and then the fuel system is checked. The fuel is injected 20 times within two seconds.

**⚠ WARNING**

- **Do not perform the test with the injector removed from the throttle body or with any fuel system parts removed. High-pressure fuel could spurt out.**
- **When performing this operation, keep all sparks, flames, or other sources of ignition away from the testing area. Gasoline is highly flammable.**

1. Select the test that you wish to perform by either clicking it or pressing the up or down arrow keys on your keyboard. (Fig. 48)

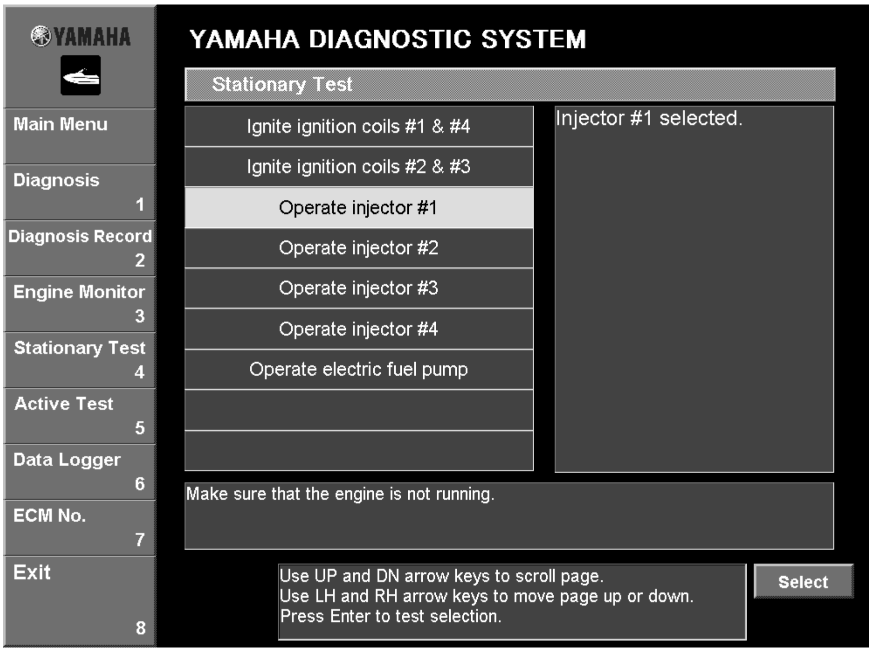



Fig. 48

**NOTE:**

- Make sure that the engine is not running.
- The selected item is highlighted in light blue.
- The details of the selected test are displayed in the column on the right, and the items that must be either checked or performed before the test can start are displayed below the table.
- Only one item can be selected at one time.
- Make sure that there is fuel in the fuel tank, otherwise an error will occur and the test cannot be performed.

2. Select the cylinder to be tested, and then click the **Select** button or press the Enter key on your keyboard. (Fig. 48)

3. Click the **Execute** button or press the Enter key on your keyboard. (Fig. 49)

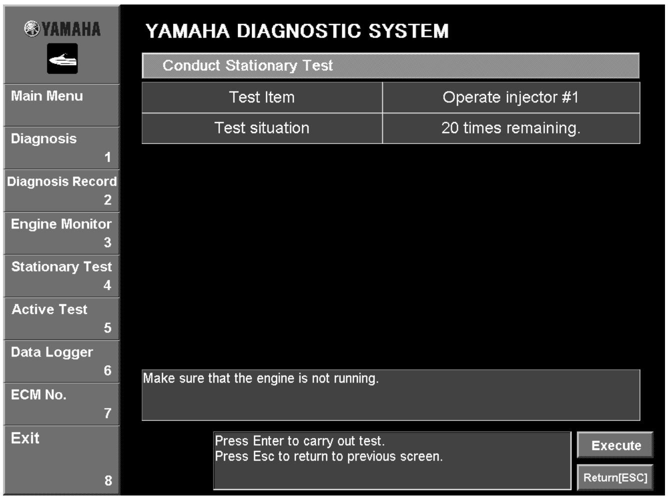



Fig. 49

**NOTE:**

If an error occurs while the test is being performed, an error message is displayed. Follow the instructions that appear.

4. Listen to the operating sound of the injector of the cylinder being tested.

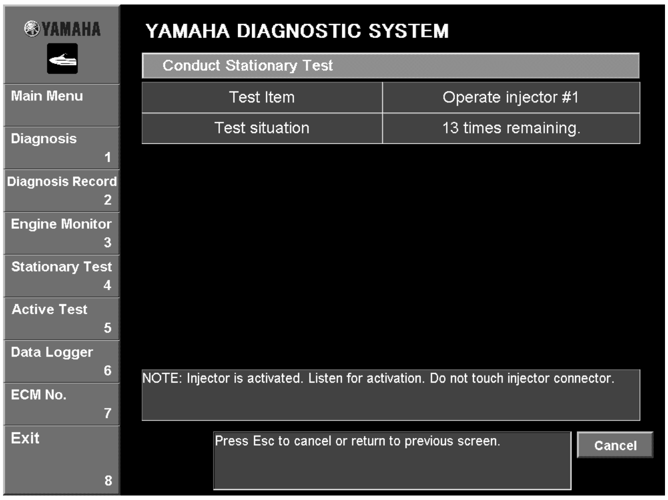



Fig. 50

**⚠ WARNING**

**Do not touch the injector connector.**

5. To perform the test again on the same cylinder, click the **Execute** button or press the Enter key on your keyboard. To perform the test on a different cylinder, click the **Return [ESC]** button or press the Esc key on your keyboard to return to the window where a different test can be selected. (Fig. 51)

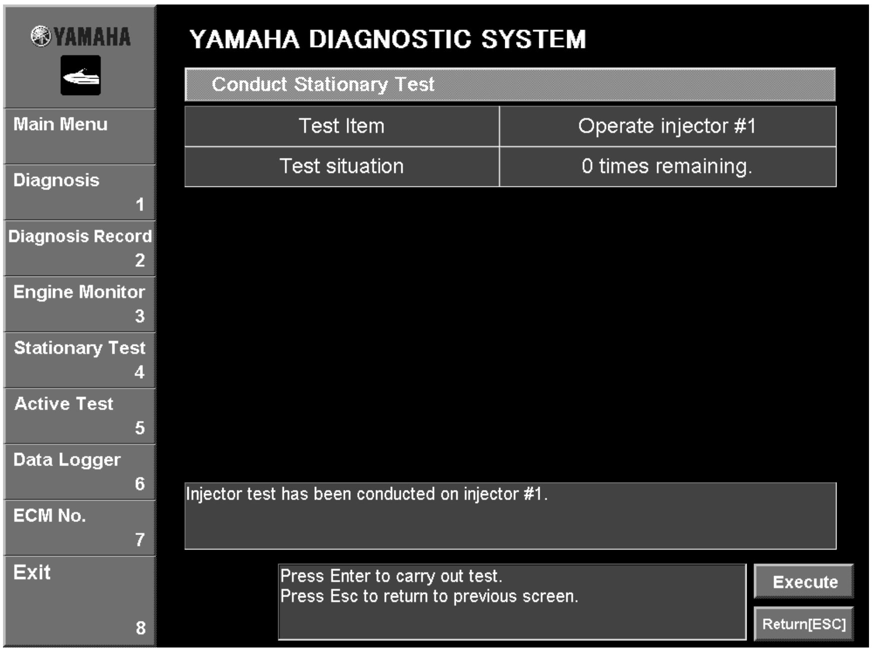



Fig. 51

**CAUTION:**

**Do not test the same cylinder three or more times, otherwise the spark plug insulator could be damaged.**

**Operating the electric fuel pump:**

A voltage is applied to the electric fuel pump, the electric fuel pump is operated, and then the fuel system is checked. The electric fuel pump is operated for ten seconds.

**⚠ WARNING**

- **Do not perform the test with the injector removed from the throttle body or with any fuel system parts removed. High-pressure fuel could spurt out.**
- **When performing this operation, keep all sparks, flames, or other sources of ignition away from the testing area. Gasoline is highly flammable.**

**NOTE:**

Make sure that there is fuel in fuel tank, otherwise an error will occur and the test cannot be performed.

1. Select the test to be performed, and then click the **Select** button or press the Enter key on your keyboard. (Fig. 52)

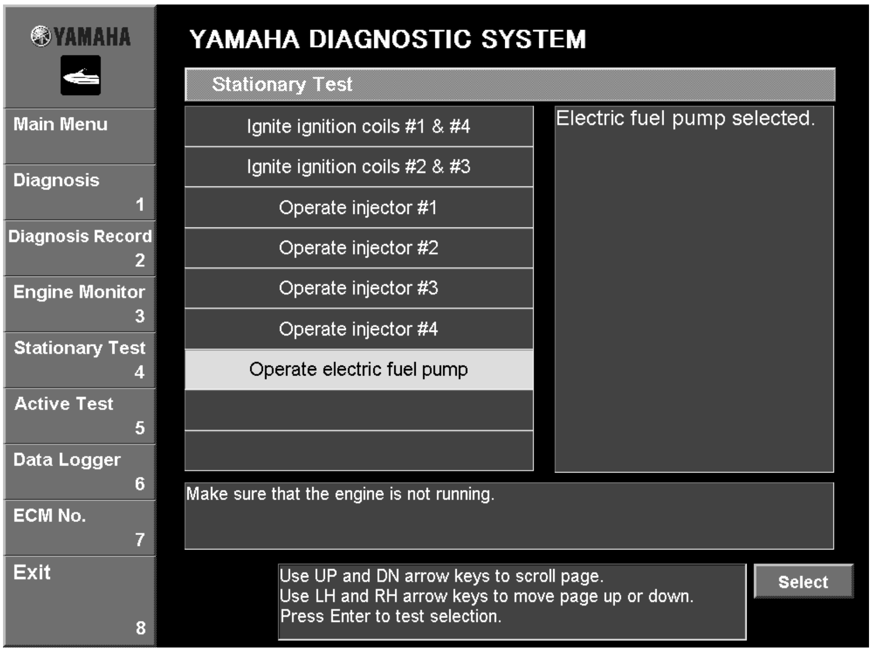



Fig. 52

**NOTE:**

- Make sure that the engine is not running.
- The selected item is highlighted in light blue.
- The details of the selected test are displayed in the column on the right, and the items that must be either checked or performed before the test can start are displayed below the table.
- Only one item can be selected at one time.

2. Click the **Execute** button or press the Enter key on your keyboard. (Fig. 53)

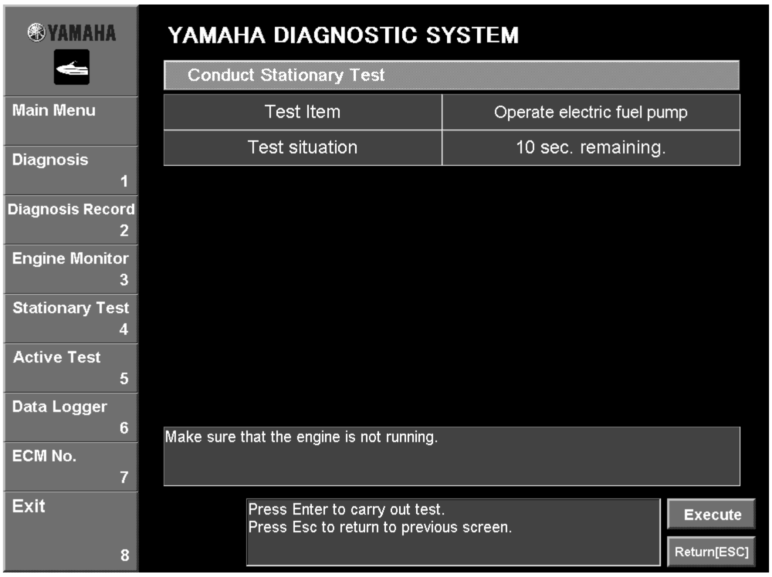



Fig. 53

**NOTE:**

If an error occurs while the test is being performed, an error message is displayed. Follow the instructions that appear.

3. Listen to the operating sound of the electric fuel pump.
4. To perform the test again, click the **Execute** button or press the Enter key on your keyboard. To perform a different test, click the **Return [ESC]** button or press the Esc key on your keyboard to return to the window where a different test can be selected. (Fig. 54)

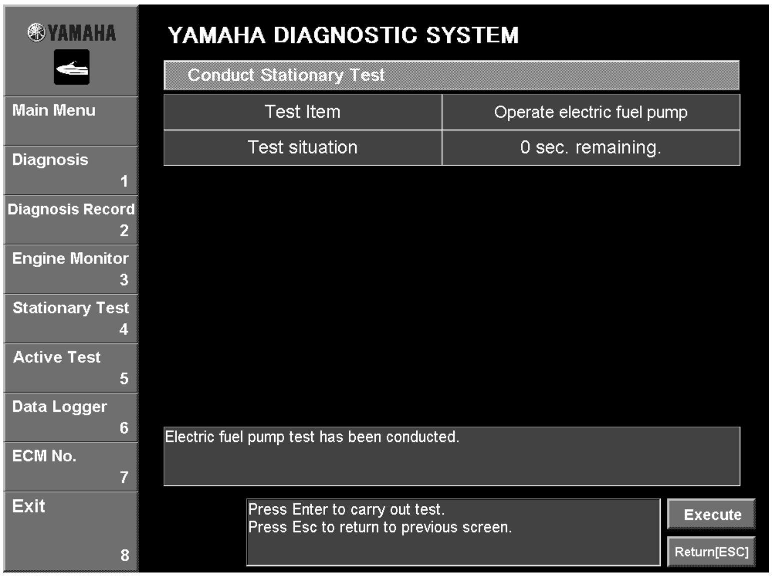



Fig. 54

## ACTIVE TEST

Selecting this command displays a window where active tests can be selected.

**⚠ WARNING**

**Avoid clicking the Execute and Cancel buttons repeatedly, otherwise the ECM or PC will not work properly and they could be damaged.**

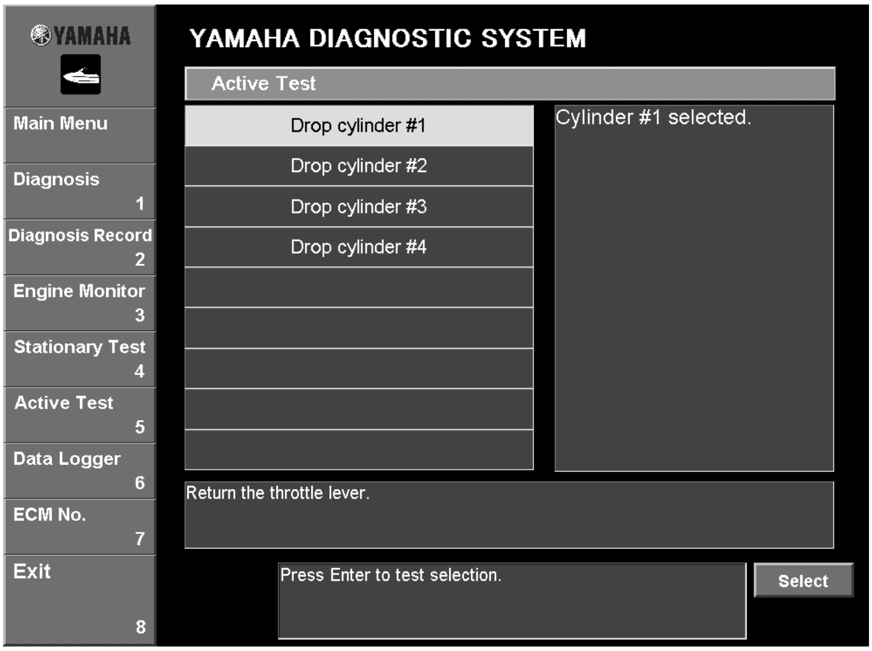



Fig. 55

**NOTE:**

The test can be carried out while the engine is running. It is not possible to carry out the test while the watercraft is running.

**Dropping a cylinder:**

Start the engine and observe the changes in engine speed for 20 seconds.

For the first ten seconds operate all four cylinders, and then stop one cylinder for five seconds. For the last five seconds operate all four cylinders.

A screen that allows you to select which ignition and fuel to cut is displayed.

1. Select which ignition and fuel you wish to cut by either clicking it or pressing the up or down arrow keys on your keyboard. (Fig. 55)

**NOTE:**

- Release the throttle lever.
- The selected item is highlighted in light blue.
- The details of the selected test are displayed in the column on the right, and the items that must be either checked or performed before the test can start are displayed below the table.
- Only one item can be selected at one time.

2. Click the **Select** button or press the Enter key on your keyboard. (Fig. 55)
3. Start the engine.
4. Click the **Execute** button or press the Enter key on your keyboard. (Fig. 56)

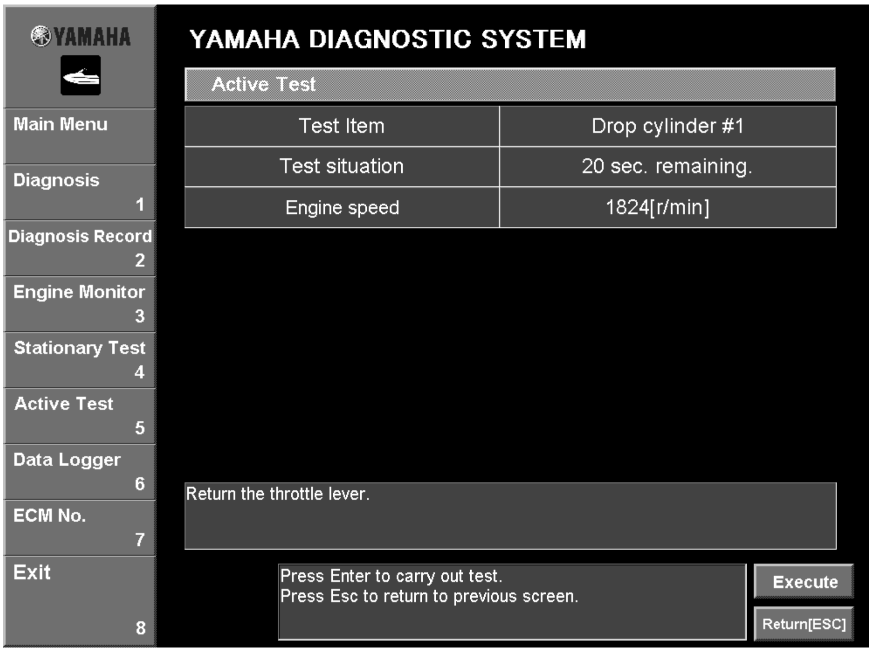



Fig. 56

**NOTE:**

If the engine is not running, an error message is displayed. Follow the instructions that appear. (Fig. 57)




Fig. 57

5. While checking the information that appears beside **Test situation** and **Engine Speed**, follow the test instructions in the messages that are displayed. (Fig. 56)

**NOTE:**

If an error occurs while the test is being performed, an error message is displayed. Follow the instructions that appear. (Fig. 58)

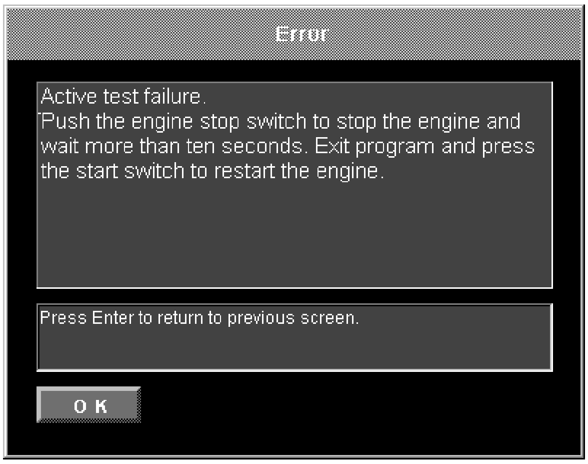



Fig. 58

6. To perform the test again on the same cylinder, click the **Execute** button or press the Enter key on your keyboard. To perform a different test, click the **Return [ESC]** button or press the Esc key on your keyboard to return to the window where a different test can be selected.

## DATA LOGGER

### Monitor item selection

A window appears that allows you to select the **Data comparison graph** or the **Engine operating hours according to engine speed**.

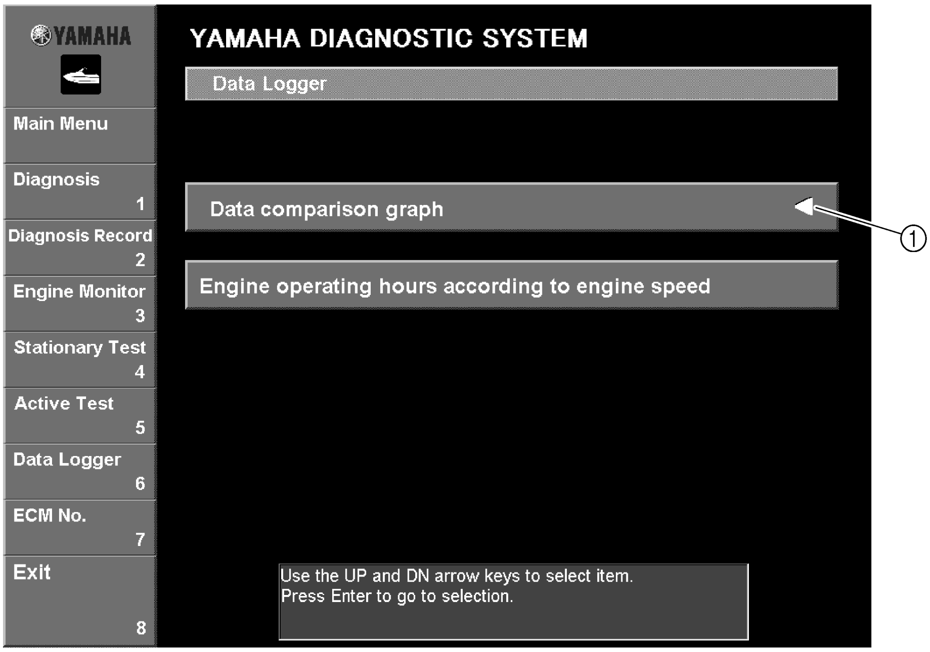



Fig. 59

① Triangle mark

**Operating procedure:**

1. Select the desired item by either clicking it or pressing the up or down arrow keys on your keyboard. (Fig. 59)

**NOTE:**

A triangle appears to the right of the selected item.

2. Press the Enter key on your keyboard. The window of the selected item is displayed. (Fig. 59)

**Data display item selection**

A window appears that allows you to select the items to be graphed. No more than two items can be displayed.

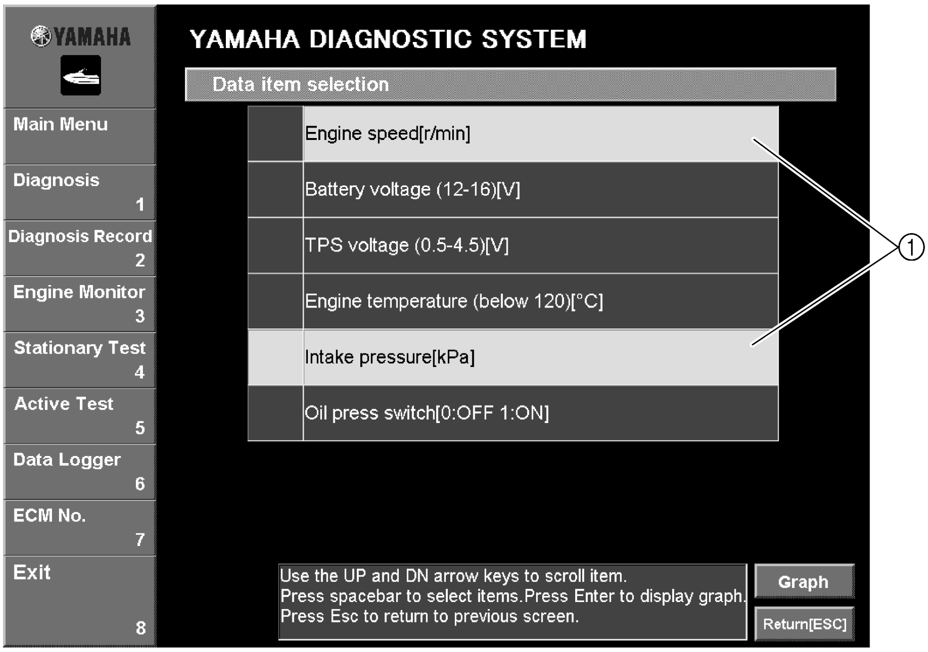



Fig. 60

① Selected items

**Operating procedure:**

1. Select the desired items by either clicking them or pressing the up or down arrow keys on your keyboard, then pressing the space bar. (Fig. 60)

**NOTE:**

- Selected items have a light blue background. Items that are not selected have a blue background. The box to the left of items that are being moved are light blue. Items that are not selected appear in blue.
- At initialization, **Engine speed [r/min]** is selected.

2. Click the **Graph** button or press the Enter key on your keyboard. (Fig. 60) The **Data comparison** window is displayed. (See fig. 61.)

**Data comparison graph**

A line graph appears with the items selected in the **Data display item selection** window on the vertical axes and the **Time before engine stop** on the horizontal axis. (Fig. 61)

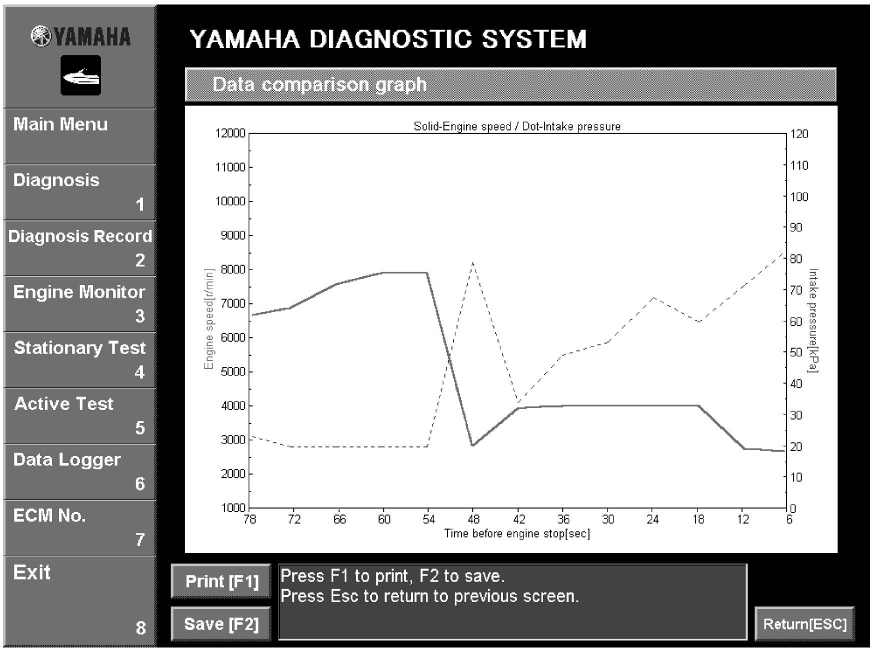



Fig. 61

**NOTE:**

- The item on the left vertical axis is graphed with a solid line and the item on the right vertical axis is graphed with a dotted line.
- Although the engine is running, graphs do not show the present engine condition. It displays the value at the time the Enter key on your keyboard was pressed in the **Monitor item selection**.

**Engine operating hours according to engine speed**

The operating hours as compared to the engine speed and the total operating hours are displayed. (Fig. 62)

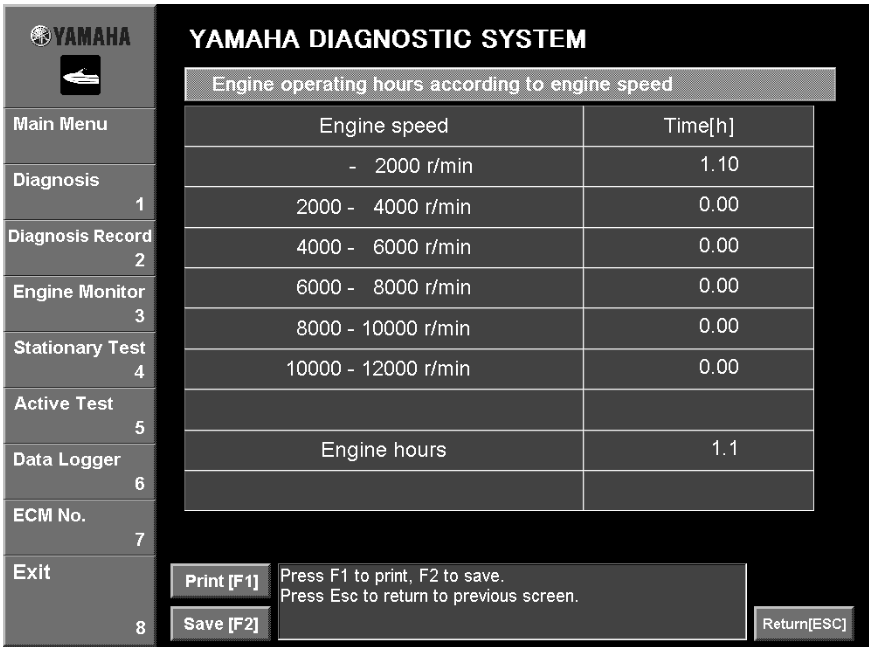



Fig. 62

A window is displayed showing the amount of hours that the engine is operated at each engine speed range.

**NOTE:**

- Although the engine is running the displayed time refers to the added hours until the Data logger starts.
- The sum of the **Engine operating hours according to engine speed** is not equal to the total hours of operation since the hours are rounded to two decimals.

## ECM No.

The ECM part number of the watercraft is read from the ECM and is displayed. (Fig. 63)

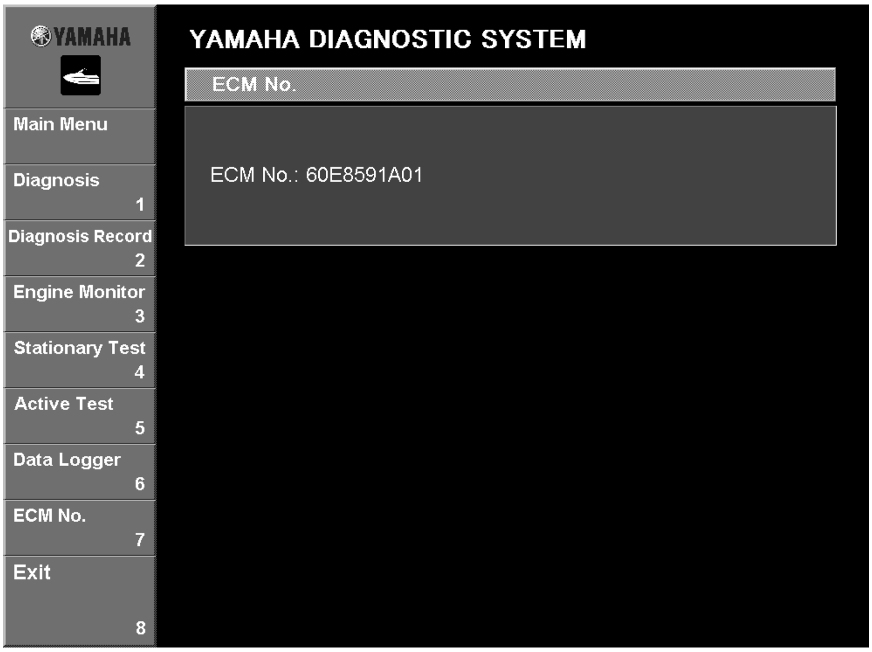



Fig. 63

## EXIT

The program is exited.

**Operating procedure:**

1. Click the **Exit** button or press any number key (1–8).

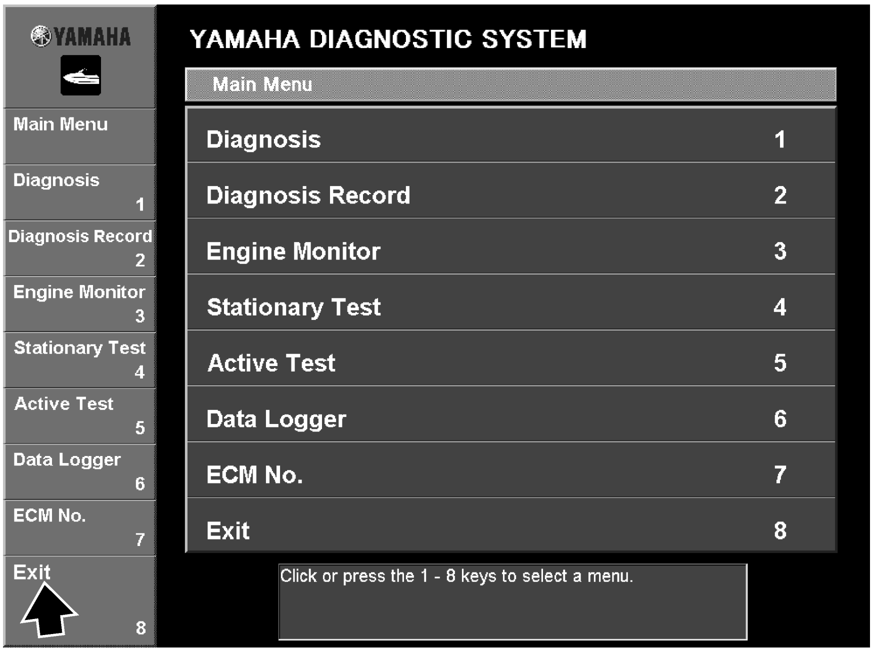



Fig. 64

2. Click the **OK** button or press the Enter key on your keyboard to exit the program.
   To cancel exiting the program, click the **Cancel** button or press the Esc key on your keyboard. (Fig. 65)

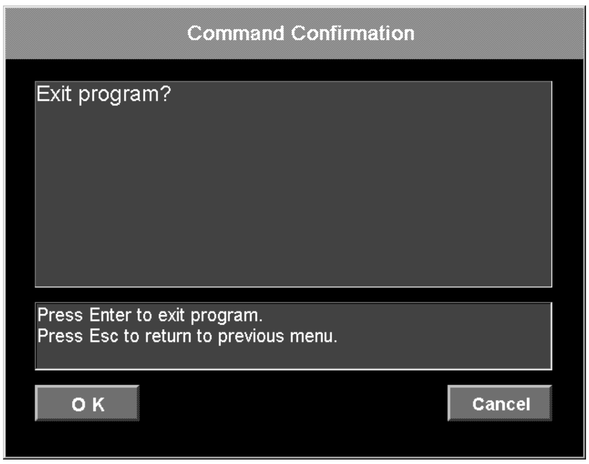



Fig. 65

## UNINSTALLING THE YAMAHA DIAGNOSTIC SYSTEM

Use the following procedure to uninstall the Yamaha Diagnostic System.

1. Exit all programs before running the uninstaller.
2. From the taskbar at the bottom of your computer screen, click the **Start** button, point to **Settings,** and then open the **Control Panel**.
3. In the Control Panel dialog box, double-click **Add/Remove Programs**. (Fig. 66)




Fig. 66

4. Select **YAMAHA DIAGNOSTIC SYSTEM for WaterCraft** and click the **Add/Remove** button. (Fig. 67)

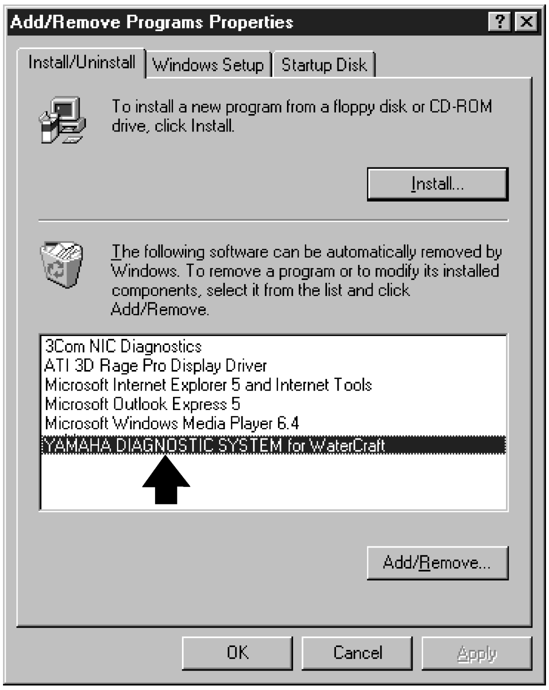



Fig. 67

5. Click the **Yes** button in the confirmation window to uninstall the utility software. To cancel the uninstall operation of the utility software, click the **No** button. (See figs. 68–70.)

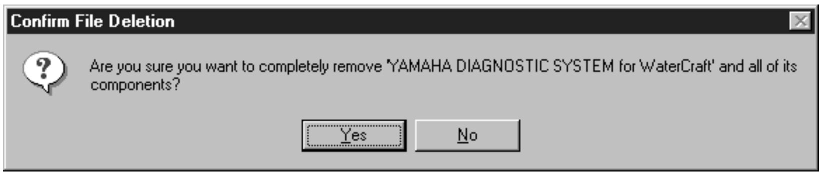



Fig. 68

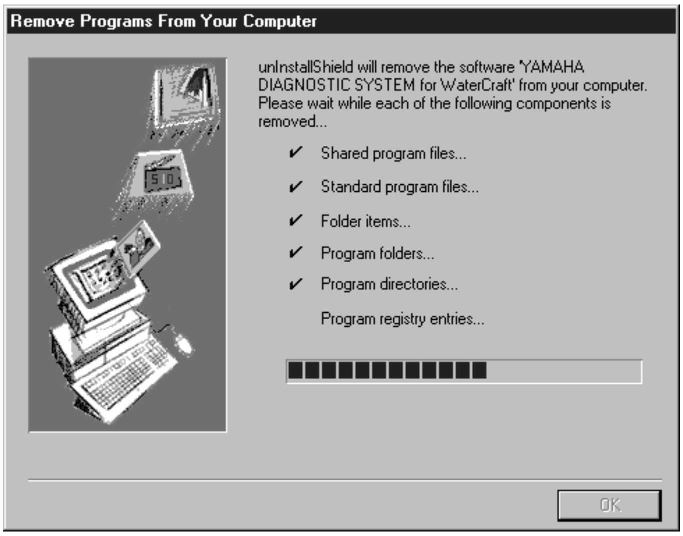



Fig. 69

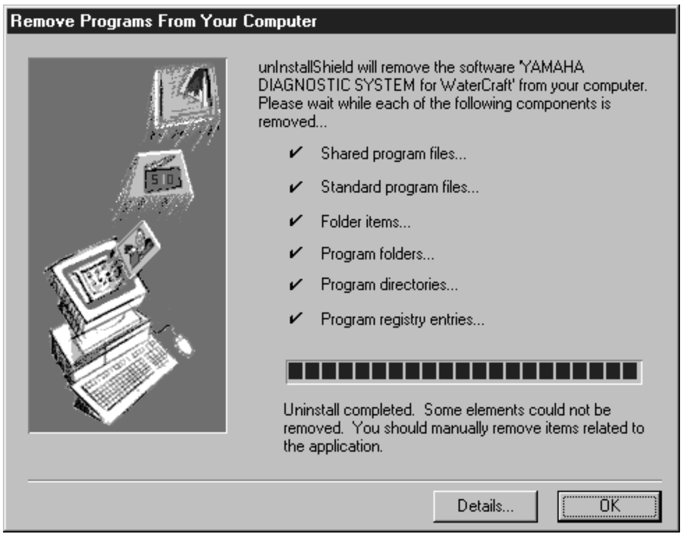



Fig. 70

6. If the following message appears, click the **Details...** button.

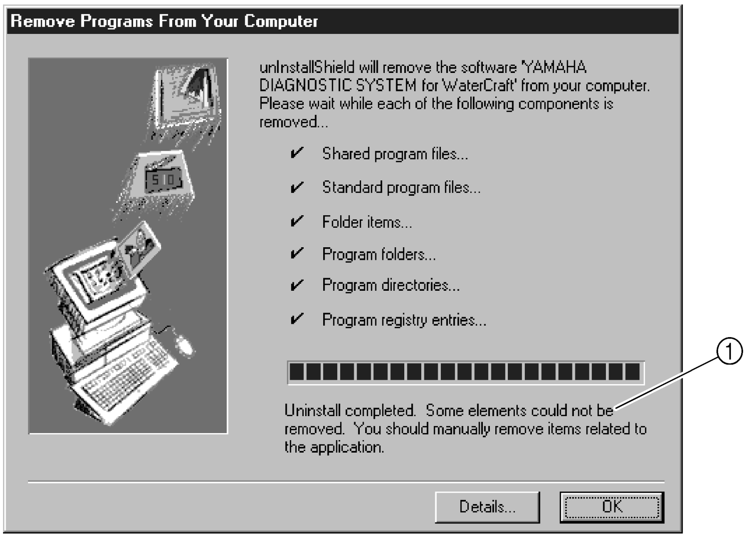



Fig. 71

① Uninstall completed. Some elements could not be removed. You should manually remove items related to the application.

7. Check the contents of the message. If an element could not be removed, delete it manually.

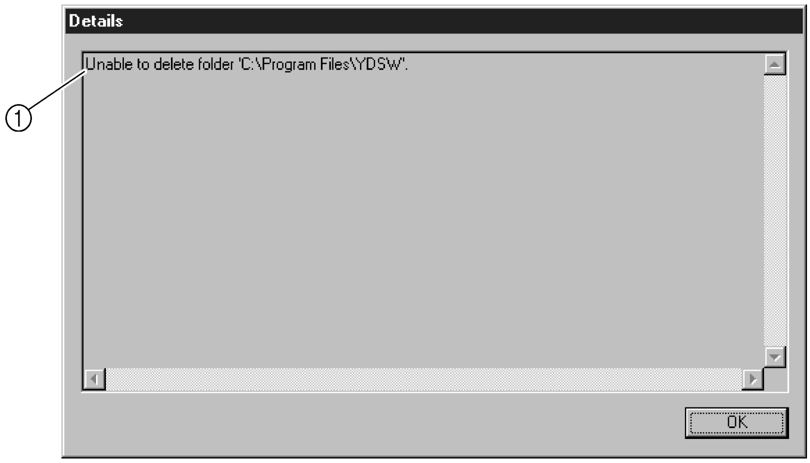



Fig. 72

① Elements that could not be removed.

# TROUBLESHOOTING

| Error content | Cause | Action |
|---|---|---|
| Communication cable related error occurs | Communication cable is disconnected. | Connect communication cable between the computer's communication port and 3-pin communication coupler of the watercraft. |
| | Battery is disconnected from the watercraft. | Connect battery to watercraft. |
| | The battery voltage is below 12 V. | Connect battery of 12 V or higher. |
| Application does not start | The hardware does not meet the requirements to operate this application. | Use a computer that meets the specified hardware requirements. |
| | YDIS.exe is not installed in application directory. | If YDIS.exe is not found in the application directory, install the application again. |
| | Other application (Service tool) is already in operation. | Quit the application in operation, since two applications (Service tool) cannot be operated simultaneously. |
| Application related error occurs | Error message "Program file or Database file is not installed properly. Please install again." is displayed. | Install program file or database file again. |
| Database related error occurs | Error message "Database files are not installed properly. Please update again." is displayed. | Update database again. |
| | Error message "System file not found ######.###." is displayed. | The database is not applicable to communication with ECM. Update database to correspond to ECM. |
| Incorrect fonts on screen | The computer language does not correspond to the application. | Use a computer that operates the required operating system. |
| When executing the stationary test or active test the test cannot be ended even if the Cancel is clicked. | Execute and Cancel buttons have been clicked more than necessary, and the ECM or PC does not operate properly. | Turn off your PC.<br>Push the engine stop switch and reset the ECM. |

# APPENDIX

## SETTING THE DESKTOP AREA

Use the following procedure to set the Yamaha Diagnostic System desktop area.
Compatible with VGA (640 × 480 pixels) or SVGA (800 × 600 pixels) or more recommended

1. From the taskbar at the bottom of your computer screen, click the **Start** button, point to **Settings,** and then open the **Control Panel**.
2. In the Control Panel, double-click **Display**. (Fig. 73)




Fig. 73

3. Select **Settings** and slide the Desktop area slider. (Fig. 74)

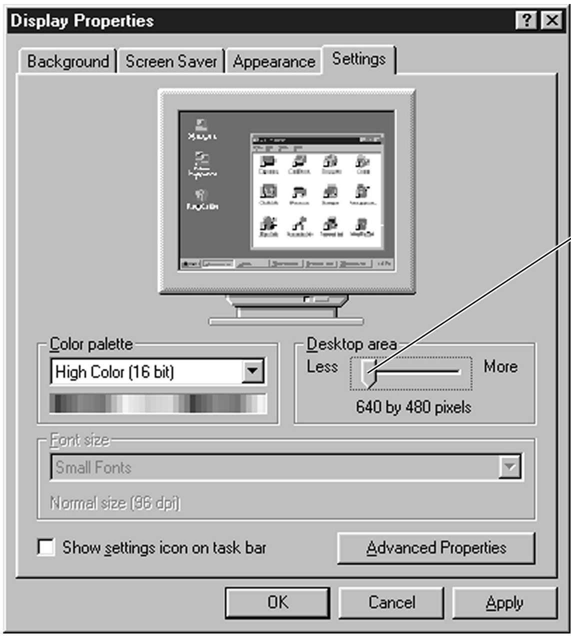



Fig. 74

① Slider

4. Click the **OK** button in the confirmation window to set the display area. To cancel, click the **Cancel** button. (See figs. 75–76.)

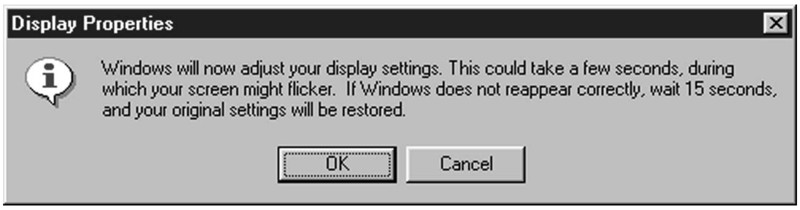



Fig. 75

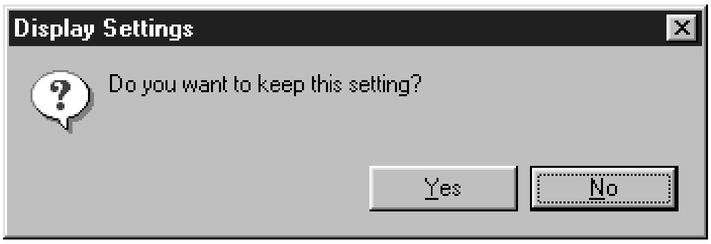



Fig. 76

# TROUBLE ANALYSIS

**NOTE:**

The following items should be checked before the “TROUBLE ANALYSIS CHART” is consulted.

1. The battery is charged and its specified gravity is within specification.
2. There are no incorrect wiring connections.
3. Wiring connections are properly secured and are not rusty.
4. The engine shut-off cord (lanyard) is installed onto the engine shut-off switch.
5. Fuel is reaching the throttle body.

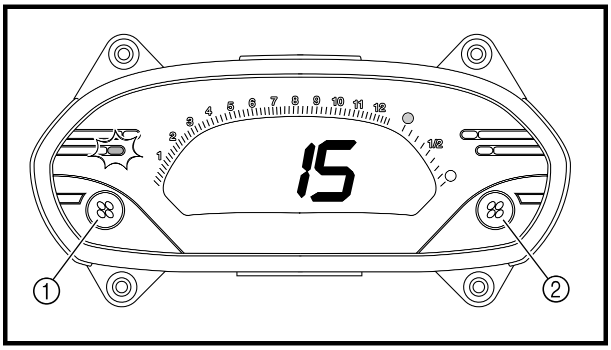
## TROUBLE ANALYSIS CHART

| Trouble mode | | | | | | | | | | | | | | | Check elements | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENGINE WILL NOT START | HARD STARTING | ROUGH IDLING | HIGH IDLING | ENGINE STALLS | POOR ACCELERATION | ENGINE WILL NOT STOP | POOR PERFORMANCE | LIMITED ENGINE SPEED | OVERHEATING | LOW OIL PRESSURE | LOOSE STEERING | BILGE INCREASE | IRREGULAR WARNING INDICATION | POOR BATTERY CHARGING | Relative part | Reference chapter |
| | | | | | | | | | | | | | | | FUEL SYSTEM | |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel tank | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel tank breather hose | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel hose | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel filter | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel pump | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel injectors | 4 |
| | | | | ○ | | | ○ | | | | | | | | Trolling speed | 3 |
| ○ | ○ | | | ○ | | | ○ | ○ | | | | | | | Air filter | 3 |

| Trouble mode | | | | | | | | | | | | | | | Check elements | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENGINE WILL NOT START | HARD STARTING | ROUGH IDLING | HIGH IDLING | ENGINE STALLS | POOR ACCELERATION | ENGINE WILL NOT STOP | POOR PERFORMANCE | LIMITED ENGINE SPEED | OVERHEATING | LOW OIL PRESSURE | LOOSE STEERING | BILGE INCREASE | IRREGULAR WARNING INDICATION | POOR BATTERY CHARGING | Relative part | Reference chapter |
| | | | | | | | | | | | | | | | POWER UNIT | |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Compression | 5 |
| ○ | ○ | ○ | | | | | ○ | ○ | ○ | | | | | | Cylinder head gaskets | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | ○ | | | | | | Cylinder block | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Crankcase | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Piston rings | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Pistons | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Bearings | 5 |
| | | | | | | | | | ○ | | | | | | Thermostat | 5 |
| ○ | | ○ | | ○ | ○ | | ○ | | | | | | | | Valve(s) and valve seat(s) | 5 |
| ○ | | ○ | | | ○ | | | | ○ | | | | | | Valve clearance adjusting pad(s) | 3 |
| ○ | | ○ | | | ○ | | | | | | | | | | Camshaft(s) | 5 |
| ○ | | | | ○ | ○ | | ○ | | ○ | | | | | | Timing chain | 5 |
| | | | | | | | | | ○ | ○ | | | | | Oil pump | 5 |
| | | | | | | | | ○ | | | | | | | Engine oil | 3 |
| | | | | | | | | | | ○ | | | | | Oil filter | 3 |
| | | | | | | | | | | | | | ○ | | Oil pressure switch | 7 |
| | | | | | | | ○ | | | | | | | | Bearing housing | 5 |
| | | ○ | | | | | ○ | | | | | | | | Drive couplings | 5 |
| | | | | | | | ○ | | | | | | | | Rubber coupling | 5 |
| | | | | | | | | | ○ | | | ○ | | | Pilot water hose | 5 |
| | | | | | | | | | ○ | | | ○ | | | Water hose | 5 |
| | | | | | | | | | ○ | | | ○ | | | Water passage | 5 |

| Trouble mode | | | | | | | | | | | | | | | Check elements | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENGINE WILL NOT START | HARD STARTING | ROUGH IDLING | HIGH IDLING | ENGINE STALLS | POOR ACCELERATION | ENGINE WILL NOT STOP | POOR PERFORMANCE | LIMITED ENGINE SPEED | OVERHEATING | LOW OIL PRESSURE | LOOSE STEERING | BILGE INCREASE | IRREGULAR WARNING INDICATION | POOR BATTERY CHARGING | Relative part | Reference chapter |
| | | | | | | | | | | | | | | | JET PUMP UNIT | |
| | | | | | | | ○ | | ○ | | | ○ | | | Duct | 6 |
| | | | | | | | ○ | | | | | | | | Impeller | 6 |
| | | | | | | | ○ | | ○ | | | | | | Intake grate | 6 |
| | | ○ | | | | | ○ | | | | | | | | Bearings | 6 |
| | | | | | | | ○ | | ○ | | | | | | Intake duct | 6 |
| | | | | | | | | | ○ | | | | | | Water inlet hose | 6 |
| | | | | | | | | | | | | ○ | | | Bilge hose | 6 |
| | | | | | | | | | | | | ○ | | | Bilge strainer | 3 |
| | | | | | | | | | | | | ○ | | | Bilge hose joint | 6 |
| | | | | | | | | | | | | | | | ELECTRICAL | |
| | | | | | | | | | | | | | | | Ignition system, fuel control system | |
| ○ | ○ | ○ | | ○ | ○ | | ○ | | | | | | | | • Pulser coils | 7 |
| ○ | | | ○ | ○ | | ○ | ○ | ○ | | | | | | | • ECM | 7 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | | | | | | | | • Ignition coils | 7 |
| ○ | | | | ○ | | ○ | | | | | | | | | • Slant detector switch | 7 |
| ○ | | | | | | ○ | | | | | | | | | • Engine stop switch | 7 |
| ○ | | | | | | ○ | | | | | | | | | • Engine shut-off switch | 7 |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | • Spark plugs | 3 |
| ○ | | | | | | ○ | | | | | | | | | • Main and fuel pump relay | 7 |
| | | | | | | | | | | | | | ○ | | • Thermoswitch | 7 |
| | ○ | ○ | ○ | | | | | | | | | | | | • Intake air pressure sensor | 7 |
| | ○ | ○ | ○ | | | | | | | | | | | | • Intake air temperature sensor | 7 |
| | ○ | ○ | ○ | | | | | | | | | | ○ | | • Engine temperature sensor | 7 |
| | | ○ | ○ | | ○ | | ○ | | | | | | | | • Throttle position sensor | 7 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | • Cam position sensor | 7 |

| Trouble mode | | | | | | | | | | | | | | | Check elements | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENGINE WILL NOT START | HARD STARTING | ROUGH IDLING | HIGH IDLING | ENGINE STALLS | POOR ACCELERATION | ENGINE WILL NOT STOP | POOR PERFORMANCE | LIMITED ENGINE SPEED | OVERHEATING | LOW OIL PRESSURE | LOOSE STEERING | BILGE INCREASE | IRREGULAR WARNING INDICATION | POOR BATTERY CHARGING | Relative part | Reference chapter |
| | | | | | | | | | | | | | | | Starting system | |
| ○ | ○ | | | | | ○ | | | | | | | | | • Start switch | 7 |
| ○ | | | | | | ○ | | | | | | | | | • Starter relay | 7 |
| ○ | | | | | | | | | | | | | | | • Starter motor | 7 |
| | | | | | | | | | | | | | | | Charging system | |
| | | | | | | | | | | | | | | ○ | • Lighting coil | 7 |
| | | | | | | | | | | | | | | ○ | • Rectifier/regulator | 7 |
| ○ | | | | | | | | | | | | | | ○ | • Fuses | 7 |
| ○ | | | | ○ | | | | | | | | | | ○ | • Battery leads | — |
| ○ | | | | | | | | | | | | | | ○ | • Battery | 3 |
| | | | | | | | | | | | | | | | Electric bilge pump | |
| | | | | | | | | | | | | ○ | | | • Electric bilge pump | 7 |
| | | | | | | | | | | | | | | | HULL AND HOOD | |
| | | | | | | | | | | | ○ | | | | Steering master | 8 |
| | | | | | | | ○ | | | | | ○ | | | Water lock | 8 |
| | | | | ○ | | | ○ | | | | | ○ | | | Exhaust hose | 8 |
| | | | | | | | ○ | | | | | ○ | | | Muffler | 8 |
| | | | | | | | | | | | | ○ | | | Drain plugs | 8 |




**Self-diagnosis**

With the engine running, press the hour meter/voltmeter display select switch ① and the speedometer display switch ② for 8 seconds and check if an error code is indicated on the multifunction meter.

| Code | Symptom |
|---|---|
| 13 | Incorrect pulser coil signal |
| 15 | Incorrect engine temperature sensor signal |
| 18 | Incorrect throttle position sensor signal |
| 19 | Incorrect battery voltage |
| 23 | Incorrect intake air temperature sensor signal |
| 24 | Incorrect cam position sensor signal |
| 29 | Incorrect intake air pressure sensor signal |
| 39 | Incorrect oil pressure sensor signal |
| 47 | Incorrect slant detection switch signal |
| 48 | Incorrect data transmission |

If the Yamaha Diagnostic System is not used to check the symptoms listed in the table, the error codes can be checked easily with the self-diagnosis in the multifunction meter. However, if there are numerous error codes displayed, be sure to check them with the Yamaha Diagnostic System.

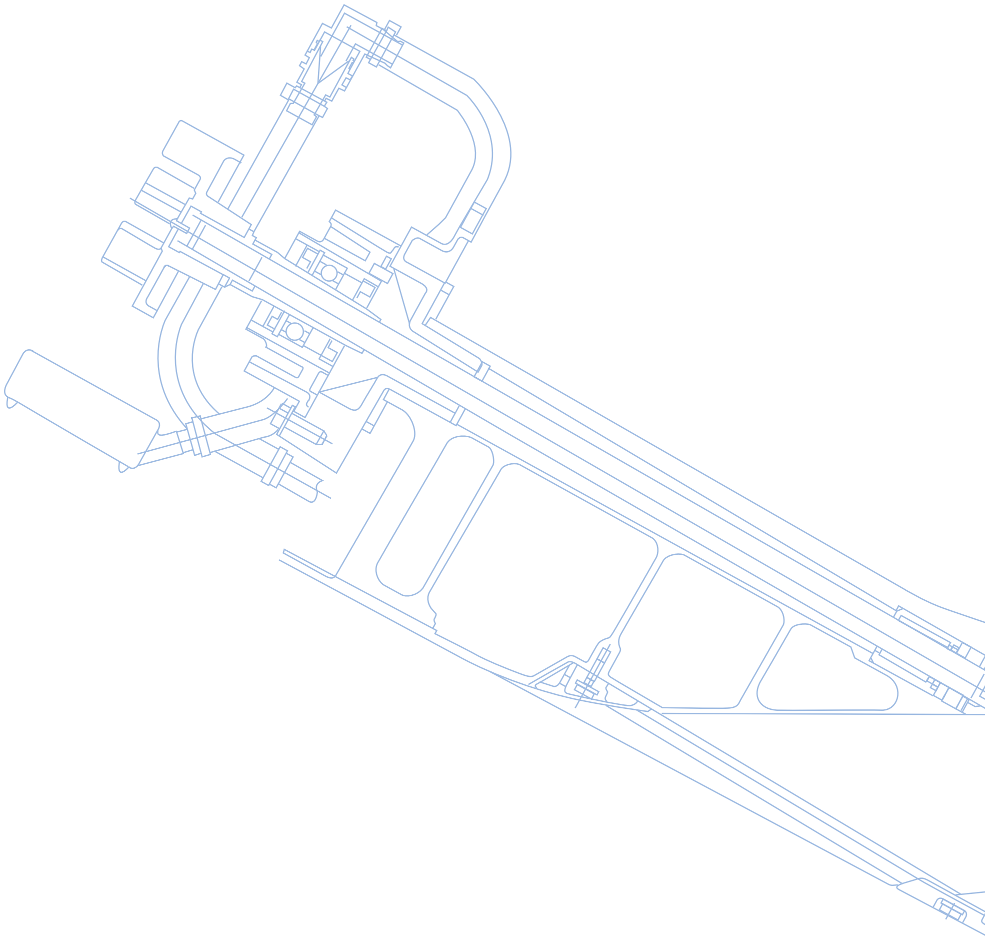
# WIRING DIAGRAM
# FX140

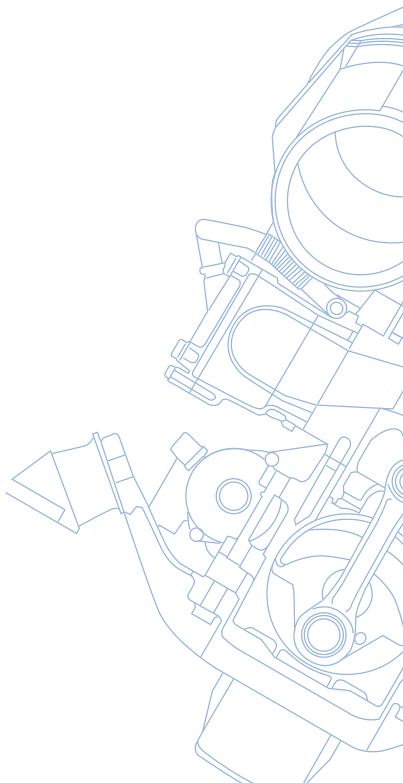
① Fuse (20A)
② Fuse (3A)
③ Starter relay
④ Slant detection switch
⑤ Main and fuel pump relay
⑥ ECM
⑦ Rectifier Regulator
⑧ Cam position sensor
⑨ Thermoswitch (exhaust)
⑩ Oil pressure switch
⑪ Thermoswitch (engine)
⑫ Engine temperature sensor
⑬ Intake air pressure sensor
⑭ Intake air temperature sensor
⑮ Throttle position sensor
⑯ Fuel injector
⑰ Ignition coil
⑱ Spark plug
⑲ Pulser coil
⑳ Lighting coil
㉑ Battery
㉒ Starter motor
㉓ Electrical bilge pump
㉔ Fuel pump
㉕ Fuel sender
㉖ Engine stop switch
㉗ Engine shut-off switch
㉘ Start switch
㉙ Meter
㉚ Speed sensor
㉛ Buzzer

[A] To tachometer

## Color code

| | |
|---|---|
| B | : Black |
| Br | : Brown |
| G | : Green |
| L | : Blue |
| O | : Orange |
| P | : Pink |
| R | : Red |
| W | : White |
| Y | : Yellow |
| B/G | : Black/green |
| B/O | : Black/orange |
| B/R | : Black/red |
| B/W | : Black/white |
| B/Y | : Black/yellow |
| G/O | : Green/orange |
| L/B | : Blue/black |
| L/R | : Blue/red |
| P/G | : Pink/green |
| P/W | : Pink/white |
| Pu/B | : Purple/black |
| Pu/G | : Purple/green |
| Pu/R | : Purple/red |
| Pu/Y | : Purple/yellow |
| R/Y | : Red/yellow |
| R/W | : Red/white |
| W/B | : White/black |
| W/R | : White/red |

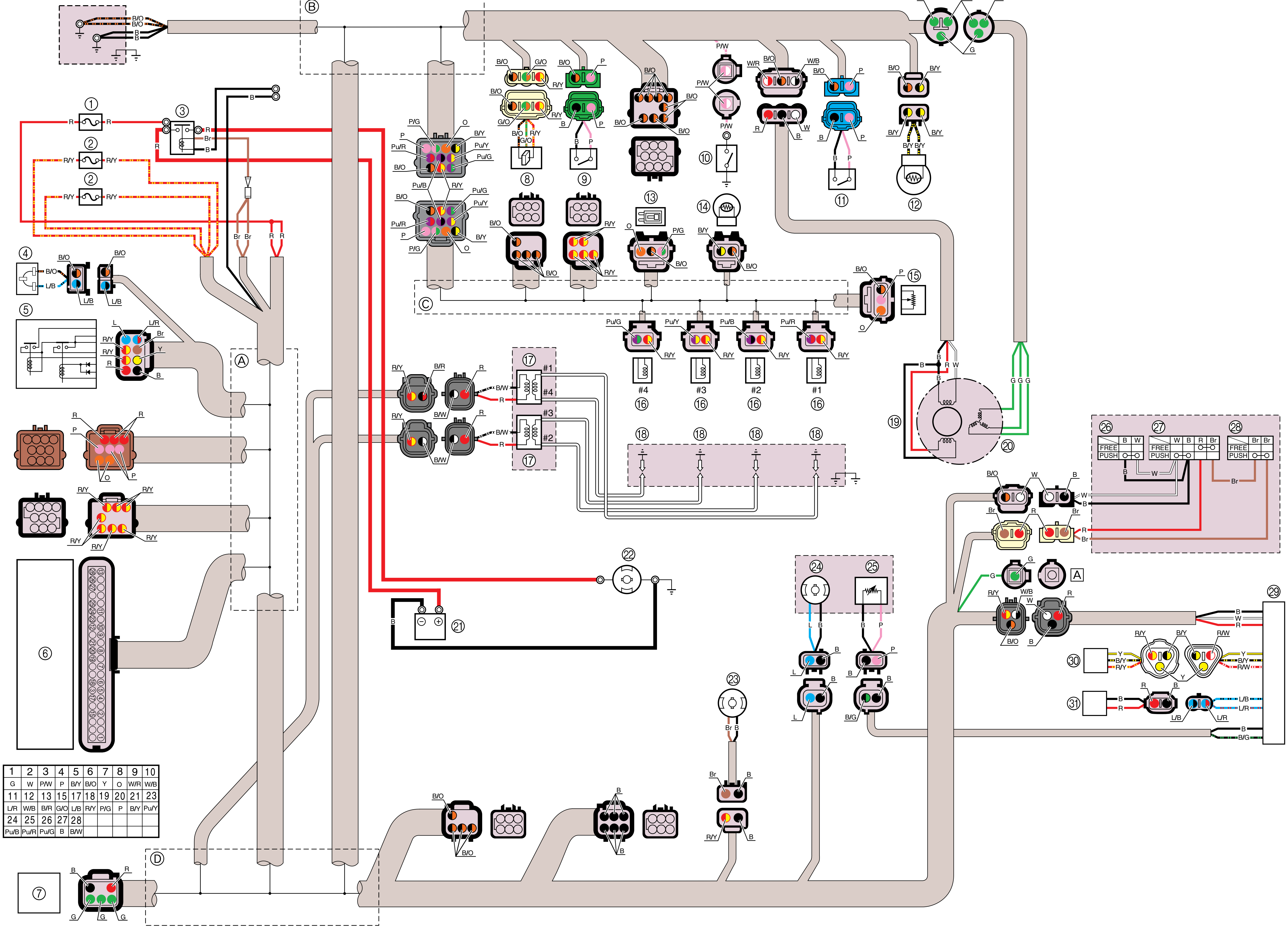




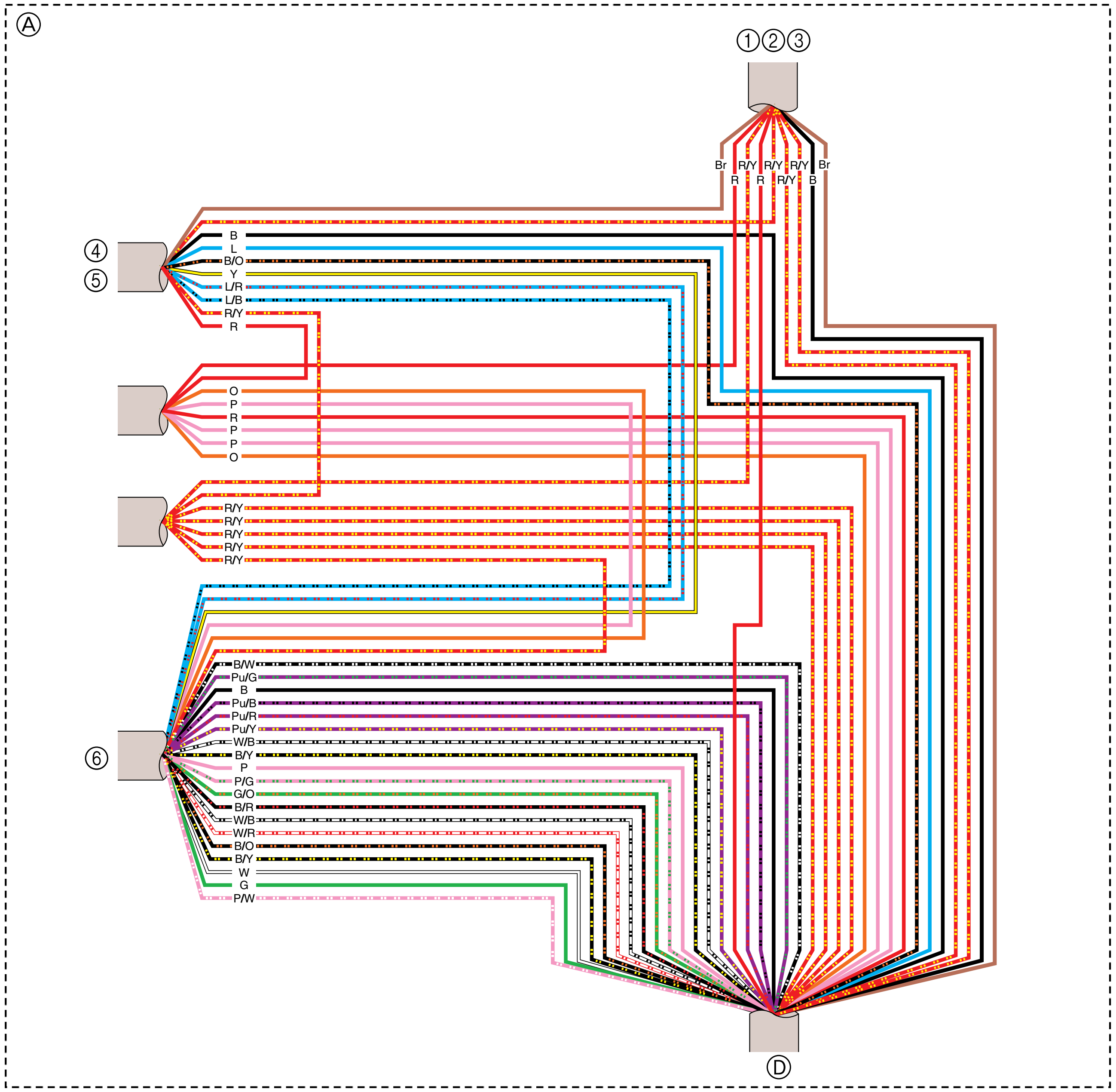
YAMAHA MOTOR CORPORATION, USA

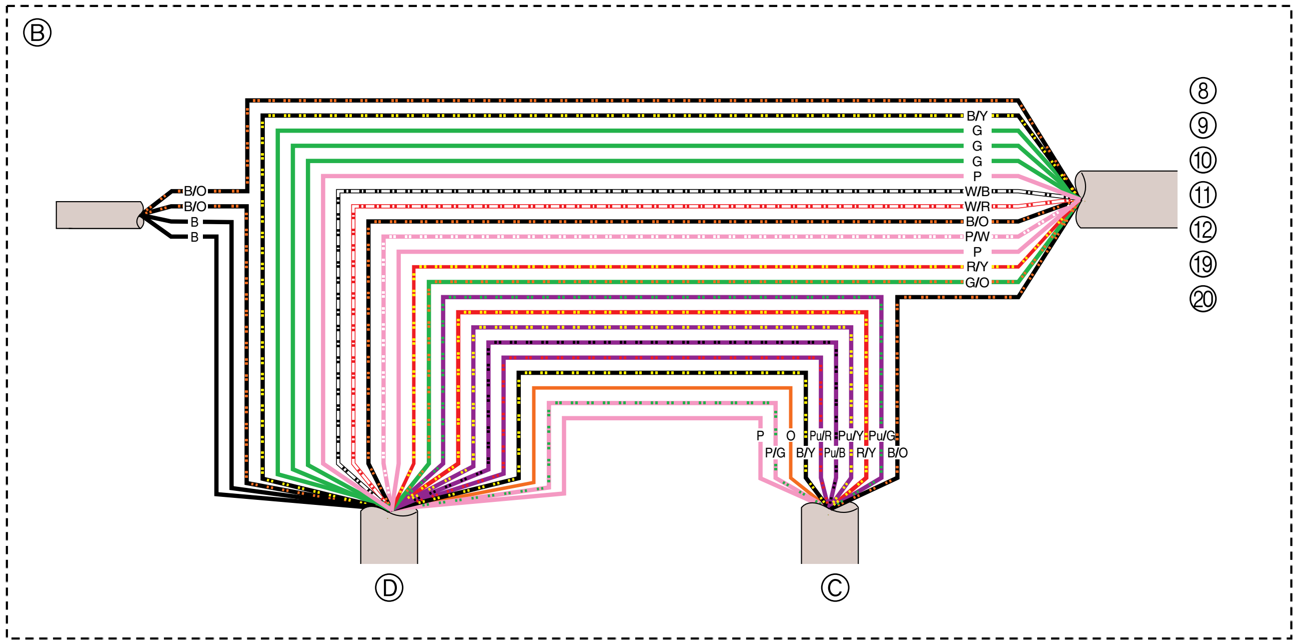
Printed in USA
Mar. 2002 – × 1 CR
**F1B-28197-1E-11**
(FX1000-A)
(E_1)

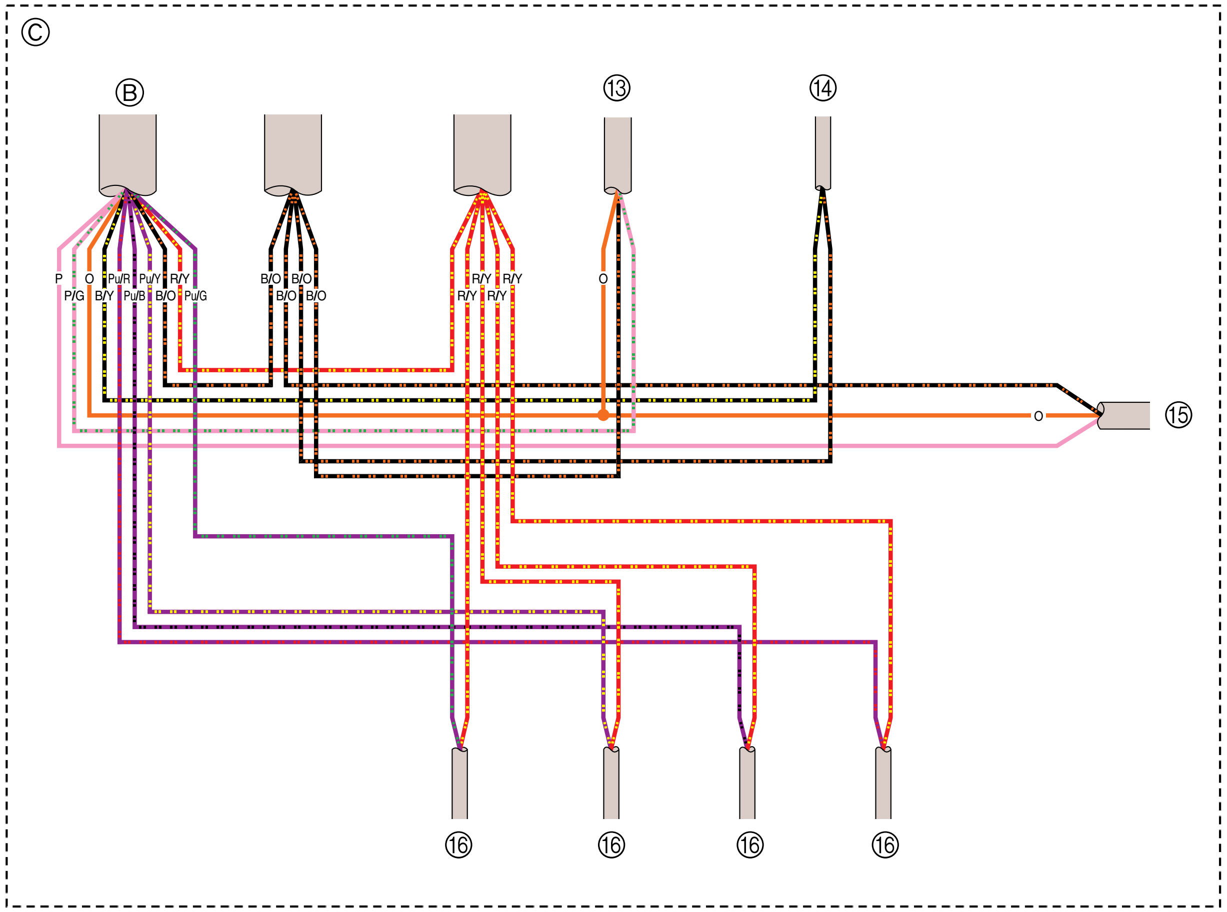
**FX140**

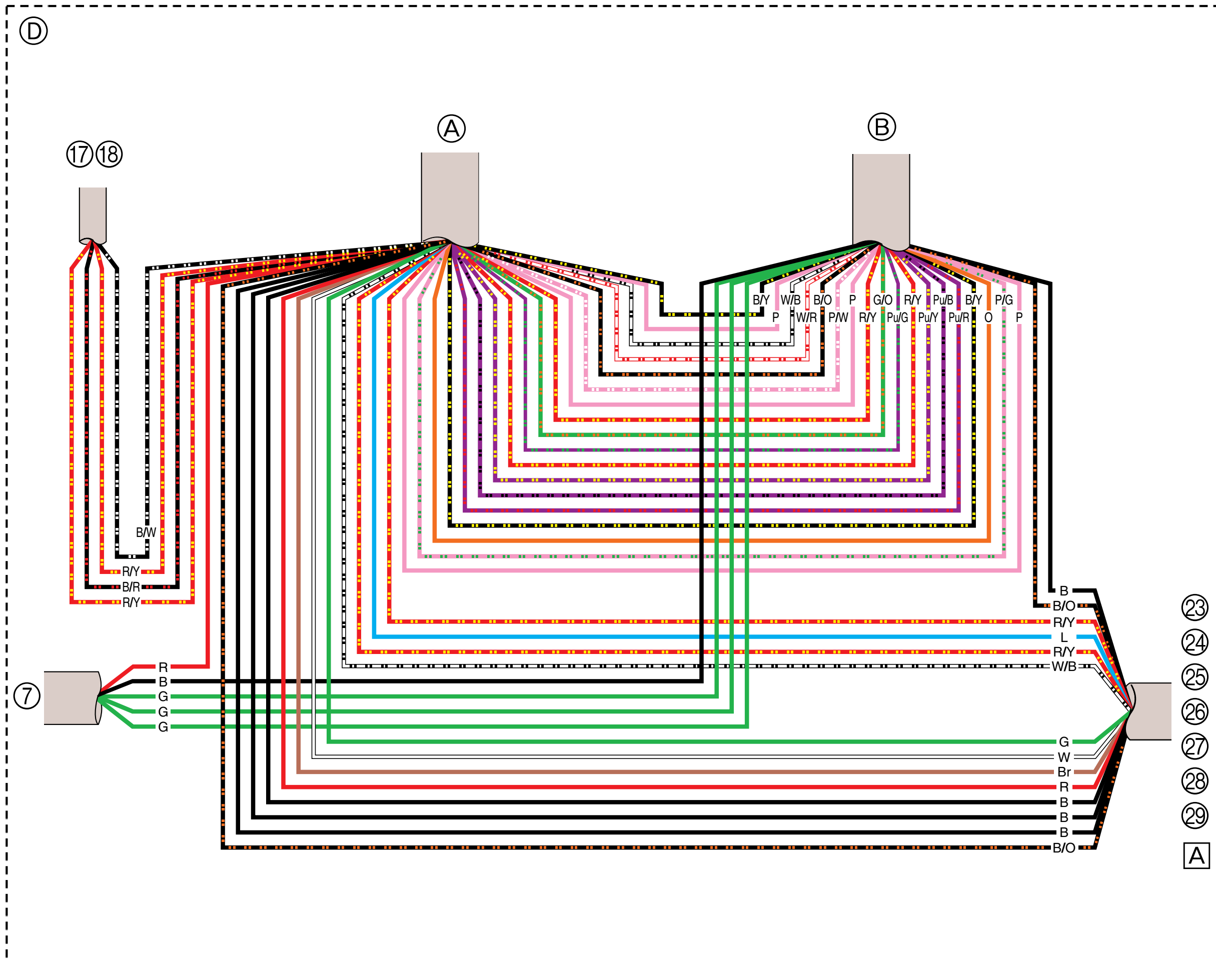



| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| G | W | P/W | P | B/Y | B/O | Y | O | W/R | W/B |
| 11 | 12 | 13 | 15 | 17 | 18 | 19 | 20 | 21 | 23 |
| L/R | W/B | B/R | G/O | L/B | R/Y | P/G | P | B/Y | Pu/Y |
| 24 | 25 | 26 | 27 | 28 | | | | | |
| Pu/B | Pu/R | Pu/G | B | B/W | | | | | |


Ⓐ
①②③
Br R/Y R/Y Br
R R R/Y B
④
⑤
B
L
B/O
Y
L/R
L/B
R/Y
R
O
P
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R/Y
G/O
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⑩
⑪
⑫
⑲
⑳
P O Pu/R Pu/Y Pu/G
P/G B/Y Pu/B R/Y B/O
Ⓓ
Ⓒ


Ⓒ
Ⓑ
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⑭
P O Pu/R Pu/Y R/Y
P/G B/Y Pu/B B/O Pu/G
B/O B/O
B/O B/O
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R/Y R/Y
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⑯ ⑯ ⑯ ⑯


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Ⓐ
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P W/R P/W R/Y Pu/G Pu/Y Pu/R O P
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